GUIDE TO WEED CONTROL

2016–2017

Publication 75

Ministry of Agriculture,
Food and Rural Affairs

Ontario

Discard old editions of this publication. Each year the appropriate sub-committee of the Ontario Pest Management Research and Services Committee reviews the pesticides listed in this publication. To the best knowledge of the committee, at the time of printing, the pesticide products listed in this publication were:

- federally registered
- classified by the Ministry of the Environment and Climate Change (MOECC)

The information in this publication is general information only. The Ontario Ministry of Agriculture, Food and Rural Affairs does not offer any warranty or guarantee, nor do they assume any liability for any crop loss, animal loss, health, safety or environmental hazard caused by the use of a pesticide mentioned in this publication.

This publication lists a number of brand names of pesticides. It is neither an endorsement of the product nor a suggestion that similar products are ineffective.

The Pesticide Label

Consult each product label before you use a pesticide. The label provides specific information on how to use the product safely, hazards, restrictions on use, compatibility with other products, the effect of environmental conditions, etc.

The pesticide product label is a legal document. It is against the law to use the product in any other way.

Registration of Pesticide Products

The Pest Management Regulatory Agency (PMRA) of Health Canada registers pesticide products for use in Canada based on following an evaluation of scientific data to ensure that the product has merit and value; and the human health and environmental risks associated with its proposed use are acceptable.

1. **Full Registration**
   Pesticide registrations are normally granted for a period of five years, subject to renewal.
2. **Conditional Registration**
   Conditional registration may be granted for a specified, limited time period, where the registrant agrees to produce additional scientific or technical information, or the pesticide is used for emergency control of a serious pest outbreak.

Maximum Residue Limits

The PMRA has established maximum residue limits (MRLs) for pesticides. Processors or retailers may demand more restrictive limits. Growers should seek advice of their intended market to determine if more restrictive limitations apply. Keep accurate and up-to-date records on pesticide use in each crop.

Supplemental Labels

You MUST obtain a supplemental label and follow all the label directions when PMRA approves new uses for a registered pesticide that do not appear on the current label.

Examples of when you must use a supplemental label include:

- **Emergency Use Registration**
- **Minor Use Label Expansion**

You can obtain a copy of a supplemental label from the pesticide manufacturer or pesticide vendor, the grower association that sponsored the emergency registration or minor use, from OMAFRA or PMRA's Pest Management Information Service.

For more information on the federal registration status check the PMRA website at www.healthcanada.gc.ca/pmra or call 1-800-267-6315.

Regulation of Pesticides in Ontario

The MOECC is responsible for regulating pesticide sale, use, transportation, storage and disposal in Ontario. Ontario regulates pesticides by placing appropriate education, licensing and/or permit requirements on their use, under the *Pesticides Act* and Regulation 63/09.

All Pesticides must be used in accordance with requirements under the *Pesticides Act* and Regulation 63/09, which are available on the e-laws website at ontario.ca/e-laws or by calling the ServiceOntario Publications Toll-Free number: 1-800-668-9938 or 416-326-5300.

Classification of Pesticides

The Ontario Pesticides Advisory Committee (OPAC) is responsible for reviewing and recommending to the MOECC, the classification of pesticide products before they can be sold or used in Ontario. Once approved by the MOECC, classified products are posted on the MOECC website: ontario.ca/ministry-environment-and-climate-change.

Certification and Licensing

Growers and their Assistants

For information about certification for growers and training for assistants check the Ontario Pesticide Education Program website: www.opep.ca or call 1-800-652-8573.

Commercial Applicators (Exterminators) and Their Assisting Technicians

For more information about exterminator licensing and technician training, visit:

- the Ontario Pesticide Training and Certification website at www.ontariopesticide.com/index.cfm/home-page or call 1-888-620-9999 or 519-674-1575
- the Pesticide Industry Council's Pesticide Technician Program website at www.hort-trades.com or call 1-800-265-5656 or e-mail pic@hort-trades.com
- the Pesticide Industry Regulatory Council (PIRC) at www.oipma.ca.

Cette publication est aussi disponible en français.

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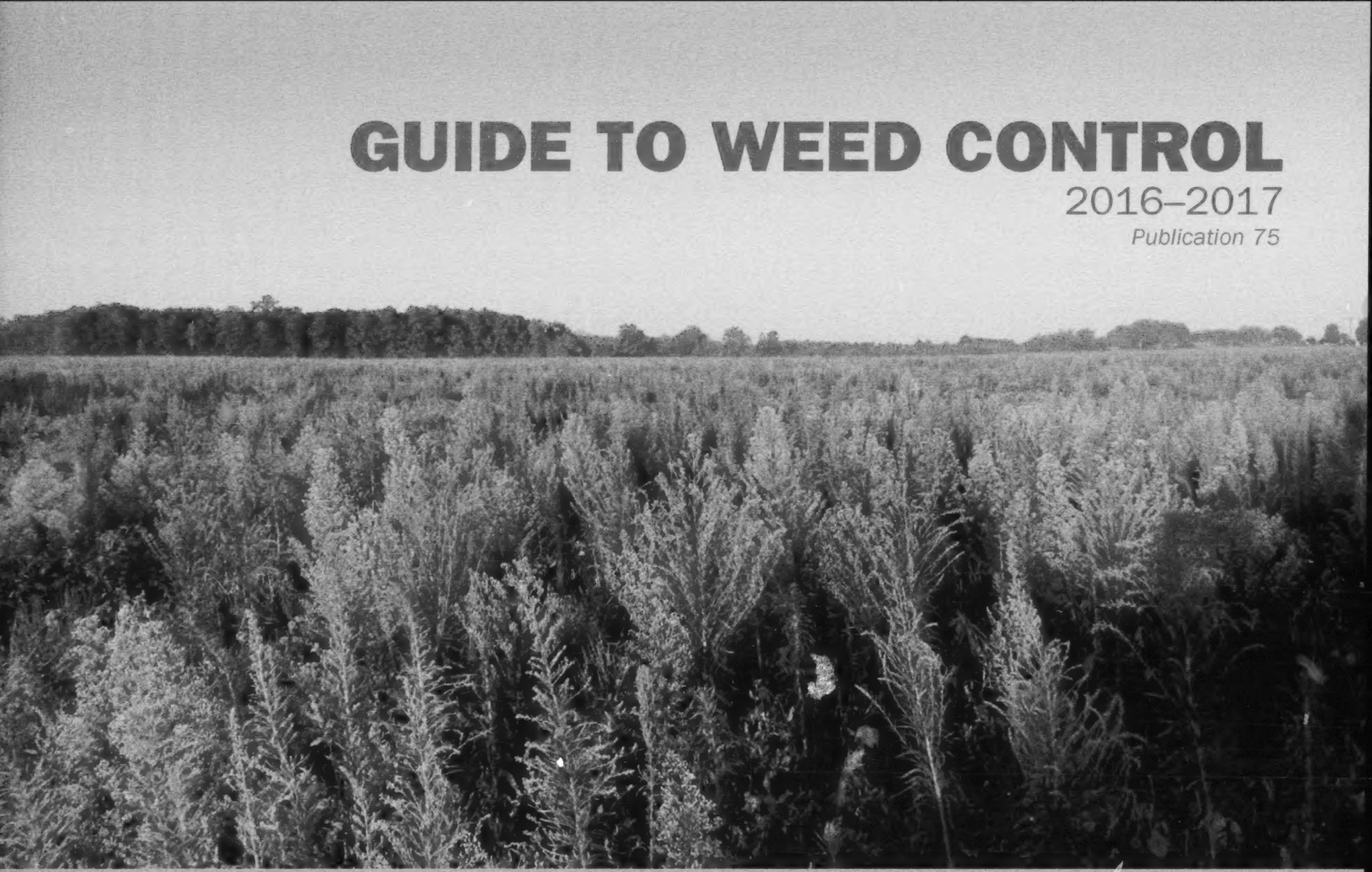

Ministry of Agriculture,
Food and Rural Affairs

Ontario

Need technical or business information?

Contact the Agricultural Information Contact Centre at
1-877-424-1300 or ag.info.omafra@ontario.ca

Looking for production information on the Internet?

ontario.ca/crops

It's one-stop shopping for factsheets, articles and photos regarding the production management of Ontario crops.

FRONT COVER Canada fleabane escapes in a field of edible beans
BACK COVER Left to right: giant ragweed, common ragweed and waterhemp

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1. MANAGEMENT STRATEGIES FOR PROBLEM WEEDS

Problem perennial and biennial weeds are challenging to control because they typically have extensive root systems that can propagate new shoots. Although difficult to eradicate it is possible to minimize the impact perennial weeds have by eliminating top growth and providing competition from desired vegetation to exhaust the root system. An integrated approach that uses tillage, cover crops and effective herbicides has proven to be the most effective way to reduce populations of problem weeds. This chapter provides a summary of over three decades of public research that has investigated management strategies for some of the most challenging weed species.

Crop Rotation

A number of long term studies have demonstrated that the density of perennial weeds increases under monoculture cropping system compared to cropping rotations consisting of three or more crops.

Cover Crops

The inclusion of cover crops such as rye, red clover, buckwheat and oilseed radish or overwintering crops like winter wheat or forages in the cropping system will suppress perennial weed growth and reduce seed production of annual and perennial weeds. Fast growing crops or crops exhibiting allelopathic properties will also suppress weed growth. It is best to kill off a lush cover crop prior to winter so that the above ground biomass can decompose prior to planting in the spring.

Tillage Systems

The type of tillage implement used and the depth at which the ground is tilled has been shown to influence the density of perennial and biennial weeds. No-till systems are more likely to increase perennial weed populations due to a lack of underground root disruption. Deep tillage (greater than 15 cm) with a moldboard plough has been shown to decrease populations of Canada thistle and perennial sow-thistle. The choice of tillage system used on any particular field should be based primarily on the soil type and slope of the land so as to minimize erosion. Its benefits to weed control should only be taken advantage of when it has the sustainability of the top soil as the priority.

Herbicide Selection

In general, the use of postemergence herbicides results in more successful top growth control of perennial and biennial weeds compared to preemergence herbicides. The strategy with in-crop postemergence herbicides is to kill off top growth so that the perennial plant must use its root reserves to generate new top growth. Every opportunity should be made to apply a systemic herbicide (e.g., glyphosate) in the fall months as the combination of shorter day lengths and cooler temperatures triggers many perennial weeds to begin allocating carbohydrates to the roots for over-wintering, which allows for translocation of a systemic herbicide down to the roots resulting in density reductions the next spring. Below are the most successful herbicide strategies for corn, soybean and cereal production on 16 different species based on University of Guelph comparative research trials conducted over more than 20 years. Always refer to each product's label for specific details about the weed species which are controlled. Refer to the precautionary statements provided for each product in the appropriate crop chapter in this guide as well as the product label.

Alfalfa, Volunteer (Retired Stand)

IMPORTANT: An old retired stand of alfalfa *must be controlled* prior to the planting of a field crop. Ideally this decision can be made in the fall so that the old stand can be tilled with a moldboard plough. If ploughing is not an option or if using a minimum till cropping system, a 3 year study by the University of Guelph demonstrated that an early spring application of glyphosate (360 g/L) at 2.5 L/ha (1 L/acre) + 2,4-D Ester (564 g/L) at 1.25 L/ha (0.5 L/acre) + non-ionic surfactant at 0.5% v/v provided the most consistent control of alfalfa compared to both fall and spring applications of other treatments. Only corn can be planted after a spring application of this treatment.

Corn – Conventional

In limited comparative trials postemergence applications of dicamba (e.g., BANVEL II) at 1.25 L/ha (0.5 L/acre), dicamba/atrazine (e.g., MARKSMAN) at 3.75 L/ha (1.5 L/acre) and DISTINCT at 285 g/ha (115 g/ac) + non-ionic surfactant at 0.25% v/v + 28% UAN at 5 L/ha (2 L/acre) have provided suppression of volunteer alfalfa. When either dicamba, dicamba/atrazine or DISTINCT is tank-mixed with ACCENT, OPTION or ULTIM, control of volunteer alfalfa is improved.

Expectation for control: 70%–75%

Corn – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") corn, glyphosate can be tank-mixed with either dicamba (e.g., BANVEL II) or dicamba/atrazine products (e.g., MARKSMAN). The co-pack called GALAXY 2 (glyphosate + ULTIM) has also demonstrated reasonably good control of volunteer alfalfa.

Expectation for control: 70%–80%

Soybeans – Conventional

If fall herbicide applications have not been made in reduced tilled soybeans, then the tank-mix of glyphosate (360 g/L) at 2.5 L/ha (1 L/acre) + 2,4-D Ester 700 at 800 mL/ha (320 mL/acre) applied 7 days preplant provides the best control of alfalfa.

Expectation for control: 75%–85%

Once soybeans have emerged, volunteer alfalfa is virtually impossible to control. REFLEX or BLAZER will burn the leaf tissue of volunteer alfalfa but the plants will grow out of the injury in 2–3 weeks. Volunteer alfalfa is tolerant to all other postemergence soybean herbicides.

Expectation for control: 40%–50%

Soybeans – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") soybean, control of volunteer alfalfa is listed on the ROUNDUP WEATHERMAX (540 g/L) label when applied at a rate of 4.67 L/ha (1.87 L/acre).

Expectation for control: 70%–80%

Cereals

In limited comparative trial work, cereal herbicides containing dichlorprop/2,4-D (e.g., ESTAPROP XT, TURBOPROP) provided the best suppression of volunteer alfalfa.

Expectation for control: 60%–70%

Bindweed, Field

Corn – Conventional

In limited comparative trials, postemergence applications of dicamba (e.g., BANVEL II) at 1.25 L/ha (0.5 L/acre) or DISTINCT at 285 g/ha (115 g/ac) + non-ionic surfactant at 0.25% v/v + 28% UAN at 5 L/ha (2 L/acre) have provided the most consistent control of emerged field bindweed.

Expectation for control: 75%–85%

Corn – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") corn, sequential applications of glyphosate (360 g/L) at 2.5 L/ha (1 L/acre) applied at the 2–3 leaf stage of corn and then again at the 7–8 leaf stage of corn to emerged field bindweed provided the most consistent level of control. Alternatively, a single application of glyphosate (360 g/L) at 5 L/ha (2 L/acre) provided comparable control to the sequential applications.

Expectation for control: 75%–85%

In glufosinate tolerant ("Liberty Link") corn, suppression of top growth can be achieved when LIBERTY is applied twice, to emerged field bindweed. The first application typically being at the 3 leaf stage of corn and at a rate of 2.5 L/ha (1 L/acre) followed by a second application at the 7–8 leaf stage of corn at a rate of 2 L/ha (0.8 L/acre). Alternatively you could tank-mix LIBERTY with dicamba (e.g., BANVEL II) and apply once to emerged field bindweed between the 2–6 leaf stage of corn.

Soybeans – Conventional

Postemergence applications of BLAZER at 2.5 L/ha (1 L/acre) or BASAGRAN FORTE at 2.25 L/ha (0.9 L/acre) can burn back the foliage of field bindweed when applied during periods of high heat, high humidity and adequate soil moisture. However, field bindweed will grow back.

Expectation for control: 40%–50%

Soybeans – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") soybean, sequential applications of glyphosate (360 g/L) at 2.5 L/ha (1 L/acre) applied at the 1st trifoliate stage of soybean and then again at the 4th trifoliate stage of soybean to emerged field bindweed provided the most consistent level of control. Alternatively, a single application of glyphosate (360 g/L) at 5 L/ha (2 L/acre) provided comparable control to the sequential applications.

Expectation for control: 75%–85%

Cereals

The challenge with field bindweed control in cereal crops is that the weed often emerges after the appropriate crop stage for herbicide applications. In winter wheat some producers have had success in applying bromoxynil/MCPA in the fall to suppress field bindweed growth the following spring. The single most important management practice that a grower can implement to reduce field bindweed is with either a pre-harvest glyphosate (360 g/L) application at 2.5 L/ha (1 L/acre) or with an application of glyphosate (360 g/L) at 3.75 L/ha (1.5 L/acre) after cereal harvest, typically in mid to late September, after field bindweed has re-grown. Both application timings will decrease the level of field bindweed to manage in the following spring. A pre-harvest application is preferred if field bindweed is at a population density that is problematic for harvesting.

Black Medick

Refer to management strategies for ALFALFA, page 2 as they apply equally to Black medick.

Bur Cucumber

Corn – Conventional

Sequential applications provide the most consistent level of control. Either CONVERGE XT or PRIMEXTRA II MAGNUM should be applied preemergence followed by a postemergence application of bromoxynil (e.g., PARDNER) + AATREX 480 or CALLISTO + AATREX 480. Bromoxynil + AATREX 480 is best applied when bur cucumber is at the 4–6 leaf stage of growth.

Expectation for control: 85%–90%

Corn – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") corn, the most consistent bur cucumber control has been achieved when glyphosate (360 g/L) is applied twice to emerged bur cucumber, with the first application occurring at the 2–3 leaf stage of corn and the second at the 7–8 leaf stage of corn. Bur cucumber at the 4–6 leaf stage requires a glyphosate (360 g/L) rate of 5 L/ha (2 L/acre) to provide adequate control.

Expectation for control: 85%–90%

Soybeans – Conventional

Sequential applications provide the most consistent level of control. In comparative trials the best control of bur cucumber was achieved when SENCOR 75DF was applied preemergence at 0.6 kg/ac (1.5 kg/ha) followed by an application of either CLASSIC/CHAPERONE at 35 g/ha (14 g/ac) with a non-ionic surfactant at 0.2% v/v or PINNACLE SG at 12 g/ha (4.8 g/ac) with a non-ionic surfactant at 0.1% v/v to bur cucumber at the 4–6 leaf stage of growth.

Expectation for control: 75%–80%

Soybeans – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") soybean, sequential applications of glyphosate (360 g/L) applied at the 1st trifoliate stage of soybean and then again at the 4th trifoliate stage of soybean provided the most consistent level of control. Bur cucumber at the 4–6 leaf stage requires a glyphosate (360 g/L) rate of 5 L/ha (2 L/acre) to provide adequate control.

Expectation for control: 85%–90%

Cereals

Typically not found in winter cereals as the crop produces enough ground cover to inhibit the germination of this summer annual weed. Cereal herbicides have not been evaluated. However in field corn, the active ingredient bromoxynil has shown to have reasonable activity on bur cucumber, therefore cereal herbicides that contain bromoxynil (e.g., BUCTRIL M, INFINITY) should provide some control of this species in cereals.

Canada Fleabane – Glyphosate Resistant

Corn

Control of glyphosate resistant Canada fleabane has been most consistent with postemergence herbicide applications but good control can be achieved with preemergence herbicides. Of the preemergence herbicides, INTEGRITY, MARKSMAN, CALLISTO + AATREX 480, BATTALION and BANVEL II are all good options. Postemergence applications of MARKSMAN, BANVEL II, PARDNER + AATREX 480 and DISTINCT are also effective on glyphosate resistant Canada fleabane. Aggressive primary tillage prior to planting to small fleabane rosettes can also be very effective.

Soybean

Glyphosate resistant Canada fleabane is most difficult to control in soybean because few options exist to control it once the soybean crop has emerged. Therefore it must be controlled prior to planting. When research trials were initially done, the pre-plant tank-mix of glyphosate + ERAGON + MERGE was the most effective option. However, as that treatment was evaluated over several seasons and locations, about one third of the time, glyphosate + ERAGON + MERGE failed to provide commercially acceptable control of glyphosate resistant Canada fleabane. To address this inconsistency, different tank-mix options were evaluated and over two seasons the addition of SENCOR 75 DF (metribuzin) at 538 g/ha (215 g/acre) to glyphosate + ERAGON + MERGE improved control of glyphosate resistant Canada fleabane. The equivalent rate of metribuzin in SENCOR 75 DF can also found in herbicides like CONQUEST LQ and CANOPY PRO.

Cereals

INFINITY is the most effective at controlling Canada fleabane in winter wheat, spring wheat and spring barley. LONTREL 360 is also an effective option if growing spring wheat and barley.

Post Cereal Harvest

Once the cereal crop is harvested, a greater amount of sunlight will hit the soil surface and will either stimulate new weed germination or growth of Canada fleabane that was suppressed by the cereal canopy. To minimize Canada fleabane seed being produced and returned to the soil, an aggressive cover crop (e.g., oats, rye, cover, oilseed radish) should be planted. Alternatively, fall tillage should be done no later than 4–6 weeks after harvest or before weed seed reaches maturity.

Canada Thistle

Corn – Conventional

In comparative trials postemergence applications of DISTINCT at 285 g/ha (115 g/ac) + non-ionic surfactant at 0.25% v/v + 28% UAN at 5 L/ha (2 L/acre) has provided excellent control of Canada thistle. Other herbicides like dicamba (e.g., BANVEL II) or dicamba/atrazine (e.g., MARKSMAN) also have good activity on Canada thistle. CALLISTO + AATREX 480 will provide suppression.

Expectation for control (with DISTINCT): 90% top growth control

Corn – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") corn, target actively growing Canada thistle at the rosette stage and no larger then 50 cm in height with an application of glyphosate (360 g/L) at 2.5 L/ha (1 L/acre). It is not advisable to tank-mix DISTINCT + glyphosate because of increased risk of crop injury.

Expectation for control: 90% top growth control

Soybeans – Conventional

Consistent control of Canada thistle is difficult to obtain in non-GMO (conventional) soybeans. In comparative trials CLEANSWEEP, BLAZER, PURSUIT or REFLEX + TURBOCHARGE were all capable of providing acceptable levels of top growth control when low populations of Canada thistle were present. However, all 4 products are inconsistent in their ability to deliver acceptable control with the most consistent product being CLEANSWEEP.

Expectation for control: 55%–90% top growth control

Soybeans – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") soybean, target actively growing Canada thistle at the rosette stage and no larger then 50 cm in height with an application of glyphosate (360 g/L) at 2.5 L/ha (1 L/acre).

Expectation for control: 90% top growth control

Cereals

The challenge with Canada thistle control in cereal crops is that the weed often emerges after the appropriate crop stage for herbicide applications. If emerged prior to the flag leaf stage of cereals, dichlorprop/2,4-D, TROPHY and MCPA Ester have provided the best top growth control. The single most important management practice that a grower can implement to reduce Canada thistle is with either a pre-harvest glyphosate (360 g/L) application at 2.5 L/ha (1 L/acre) or with an application of glyphosate (360 g/L) at 3.75 L/ha (1.5 L/acre) after cereal harvest, typically in mid to late September, after Canada thistle has re-grown to 20–25 cm. Both application timings will decrease the level of Canada thistle to manage in the following spring. A pre-harvest application is preferred if Canada thistle is at a population density that is problematic for harvesting.

Chamomile, Scentless

IMPORTANT CONSIDERATION: Scentless chamomile is extremely difficult to control once in its second year of growth. Successful management of this species relies on removing newly germinated plants. Since this species germinates and emerges in both the fall and spring, effective management must be initiated during both those emergence periods. Trying to control fall germinated scentless chamomile with selective herbicides in the spring often results in poor performance. Established plants are best controlled in the fall with either glyphosate (360 g/L) at 5 L/ha (2 L/acre) or tillage with a moldboard plough.

Corn – Conventional

Control prior to planting is essential. Given the large fibrous root mass of 2nd year and older plants, only the moldboard plough is an effective tillage method for control. Herbicide control is best obtained with preplant applications of glyphosate (360 g/L) at 5 L/ha (2 L/acre). Any postemergence herbicides tested in comparative trials did not adequately control scentless chamomile.

Expectation for control: 80%–90%

Corn – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") corn, preplant applications of glyphosate (360 g/L) at 5 L/ha (2 L/acre) provide the best level of control. It is advisable not to wait until corn has emerged to apply glyphosate as this weed will only get larger and more difficult to control.

Expectation for control: 80%–90%

Soybeans – Conventional

Use the same strategy as for corn (conventional). None of the postemergence herbicides in soybeans have achieved more than 45% visual control. BLAZER at 2.5 L/ha (1 L/acre) is the most active on scentless chamomile.

Soybeans – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") soybean, preplant applications of glyphosate (360 g/L) at 5 L/ha (2 L/acre) provide the best level of control. It is advisable not to wait until soybeans have emerged to apply glyphosate as this weed will only get larger and more difficult to control.

Expectation for control: 90% top growth control

Cereals

In winter wheat a "two application" system works best whereby the first herbicide is applied in the fall to emerged winter wheat and the second application is made in the spring during the tillering to first node stage of winter wheat. In comparative trials, REFINE SG, REFINE M and bromoxynil/MCPA have all provided good control of scentless chamomile, provided it is no bigger than the 6 leaf stage of growth. Therefore, one strategy to achieve optimum control of fall germinated scentless chamomile would be to apply bromoxynil/MCPA in the fall and then REFINE SG in the spring if spring germinated seedlings are present. PIXXARO has also demonstrated to have good activity on scentless chamomile.

Clover, Red

IMPORTANT: A lush stand of red clover, either as a cover or forage crop must be controlled in the fall if the intention is to plant a field crop in the spring. If one waits until the spring to control a stand of red clover, the level of control will not be as good and it will take that thick biomass at least 3–4 weeks to decompose enough to make a suitable seedbed. A fall moldboard plough is the only type of tillage that effectively buries a red clover stand. For minimum till cropping systems, a fall application of glyphsoate (360 g/L) at 3.75 L/ha (1.5L/acre) + either dicamba (e.g., BANVEL II) at 0.625 L/ha (0.25 L/acre) or DISTINCT at 285 g/ha (115 g/acre) is the most effective way to remove a red clover stand.

Corn – Conventional

If glyphsoate + dicamba was not applied in the fall, then it should be applied in the spring 2 weeks prior to corn planting.

If red clover plants have escaped tillage treatments, such volunteer plants can be controlled with postemergence applications of either dicamba (e.g BANVEL II) at 0.625 L/ha (0.25 L/acre), or DISTINCT at 285 g/ha (115 g/ac) + non-ionic surfactant at 0.25% v/v + 28% UAN at 5 L/ha (2 L/acre). When these broadleaf herbicides are tank-mixed with either ACCENT, OPTION or ULTIM, control of volunteer red clover is improved. CALLISTO + AATREX 480 when applied postemergence can also provide good control of volunteer red clover.

Expectation for control: 95%

Corn – Herbicide Tolerant

If glyphsoate + dicamba was not applied in the fall, then it should be applied in the spring 2 weeks prior to corn planting.

In glyphosate tolerant ("Roundup Ready") corn, glyphosate could be used at a lower use rate and tank-mixed with either dicamba or dicamba/atrazine products.

Expectation for control: 95%

Soybeans – Conventional

In reduced tilled soybeans without any fall control of red clover, glyphosate (360 g/L) at 5 L/ha (2 L/acre) provides the best level of control.

Expectation for control: 85%

Once soybeans have emerged, red clover is virtually impossible to control. REFLEX or BLAZER will burn the leaf tissue of red clover but the plants will grow out of the injury in 2–3 weeks. Red clover is tolerant to all other postemergence soybean herbicides.

Expectation for control: 40%–50%

Soybeans – Herbicide Tolerant

In reduced tilled soybeans without any fall control of red clover, glyphosate (360 g/L) at 5 L/ha (2 L/acre) provides the best level of control.

Expectation for control: 85%

If red clover escapes the preplant treatment above and is present in emerged glyphosate tolerant ("Roundup Ready") soybeans, glyphosate (360 g/L) at 3.75 L/ha (1.5 L/acre) should provide adequate control.

Expectation for control: 80%–85%

Cereals

The under-seeding of red clover in cereals has numerous benefits and is desired. Therefore if controlling weeds in a winter wheat crop under-seeded to red clover, herbicides which minimize clover injury should be used. Bromoxynil/MCPA, MCPA sodium, and MCPA/MCPB products are all registered for use on winter wheat under-seeded to red clover.

Dandelion

Corn – Conventional

A tank-mix of OPTION 2.25 OD at 1.56 L/ha (0.63 L/acre) or ULTIM at 33 g/ha (13 g/ac) + DISTINCT at 285 g/ha (115 g/ac) + non-ionic surfactant at 0.25% v/v + 28% UAN at 5 L/ha (2 L/acre) has provided the best control of dandelion in comparative trials. DISTINCT applied alone provides less visual control then when tank-mixed with OPTION or ULTIM.

Expectation for control: 75%–85%

Corn – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") corn, glyphosate (360 g/L) applied at 5 L/ha (2 L/acre) provides suppression of dandelion. The practice of tank-mixing a herbicide like dicamba, dicamba/atrazine or CALLISTO + AATREX 480 with glyphosate has not improved the level of dandelion control in limited comparative trials.

Expectation for control: 65%–70%

Soybeans – Conventional or Herbicide Tolerant

GUARDIAN (a co-pack of POLARIS + CLASSIC) applied preplant has provided the best control of dandelion in comparative trials with visual control roughly 10% higher than what GUARDIAN PLUS (a co-pack of POLARIS + CLASSIC + VALTERA) has provided.

Cereals

Comparative trials have shown that INFINITY and dichlorprop/2,4-D products have provided the best control of larger dandelions, however results can be inconsistent especially under dryer soil conditions (visual control range of 50%–95%). Smaller dandelions can be suppressed with REFINE M and 2,4-D (visual control range of 40%–75%). The optimal time to control dandelions is post cereal harvest with glyphosate (360 g/L) applied typically in mid September to early October at a rate of 2.5 L/ha (1 L/acre) if dandelions are 15 cm in diameter or less or at a rate of 5 L/ha (2 L/acre) if dandelions are larger than 15 cm in diameter.

Horsetail, Field

Corn – Conventional

Either OPTION 2.25 OD at 1.56 L/ha (0.63 L/acre), ULTIM at 33 g/ha (13 g/ac) + non-ionic surfactant at 0.2% v/v, ACCENT at 33 g/ha (13 g/ac) + non-ionic surfactant at 0.2% v/v or BROADSTRIKE RC have activity on field horsetail but effectiveness varies greatly by population.

Expectation for control: 40%–70%

The most effective herbicide treatment for field horsetail in recent University of Guelph research has been the combination of BROADSTIKE RC at 62.5 g/ha (25 g/ac) + MCPA Amine (500 g/L) at 1 L/ha (0.4 L/acre). However, this treatment MUST be applied before the 4 leaf stage of corn to minimize crop injury and yield loss. When this tank-mix combination has been applied to corn past the 4 leaf stage, significant crop injury occurs and has resulted in yield losses as great as 1.9 MT/ha (30 bu/acre), which was more than any yield loss associated with field horsetail competition.

Expectation for control: 80%

Corn – Herbicide Tolerant

Field horsetail is fairly tolerant to glyphosate. In glyphosate tolerant ("Roundup Ready") corn the tank-mix of, glyphosate + BROADSTIKE RC at 62.5 g/ha (25 g/ac) + MCPA Amine (500 g/L) at 1 L/ha (0.4 L/acre). However, this treatment MUST be applied before the 4 leaf stage of corn to minimize crop injury and yield loss. When this tank-mix combination has been applied to corn past the 4 leaf stage, significant crop injury occurs and has resulted in yield losses as great as 1.9 MT/ha (30 bu/acre), which was more than any yield loss associated with field horsetail competition.

Expectation for control: 80%

Soybeans – Conventional or Herbicide Tolerant

Glyphosate (360 g/L) at 2.5 L/ha (1 L/acre) + BROADSTRIKE RC at 87.5 g/ha (35 g/ac) applied preplant to soybeans has provided the best control of field horsetail. However, susceptibility of field horsetail to this treatment varies significantly by population.

Expectation for control: 45%–99%

Cereals

Comparative trials have shown that any cereal herbicide that contains the active ingredient MCPA will provide very effective top growth control of field horsetail.

Horse Nettle

Corn – Conventional

Postemergence applications of ULTIM at 33 g/ha (13 g/ac) + non-ionic surfactant at 0.2% v/v tank-mixed with either DISTINCT, dicamba (e.g., BANVEL II), dicamba/atrazine (e.g., MARKSMAN) or PEAKPLUS has provided the best control in comparative trials.

Expectation for control: 75%–95% top growth control

Corn – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") corn, two 2.5 L/ha (1 L/acre) applications of glyphosate (360 g/L), the first at the 2–3 leaf stage of corn and the second at the 7–8 leaf stage of corn provide the most consistent level of control. A single application of glyphosate (360 g/L) applied at a rate of 5 L/ha (2 L/acre) also provides control but not as consistent as the two application strategy.

Expectation for control: 90%–95%

Soybeans – Conventional

FIRSTRATE at 20.8 g/ha (8.5 g/ac) + non-ionic surfactant at 0.25% v/v + 28% UAN at 2.5% v/v applied postemergence is the only herbicide to provide suppression of horse nettle in non-GMO (conventional) soybeans.

Expectation for control: 70%–85% top growth control

Soybeans – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") soybean, two 2.5 L/ha (1 L/acre) applications of glyphosate (360 g/L), the first at the 1st trifoliate stage of soybean and the second at the 3rd trifoliate stage of soybean provide the most consistent level of control. A single application of glyphosate (360 g/L) at a rate of 5 L/ha (2 L/acre) also provides control but not as consistent as the two application strategy.

Expectation for control: 90%–95%

Cereals

There has been no public research done on horse nettle susceptibility to cereal herbicides. However, limited field experience would suggest that dichlorprop/2,4-D products (e.g., ESTAPROP XT, TURBOPROP, DICHLORPROP D) have some activity on horse nettle. The single most important management practice that a grower can implement to reduce horse nettle is with either a pre-harvest glyphosate (360 g/L) application at 2.5 L/ha (1 L/acre) or with an application of glyphosate (360 g/L) at 5 L/ha (2 L/acre) after cereal harvest, typically in mid to late September, after horse nettle has re-grown. Both application timings will decrease the level of horse nettle to manage in the following spring. A pre-harvest application is preferred if horse nettle is at a population density that is problematic for harvesting.

Medick, Black

Refer to management strategies for ALFALFA, page 2 as they apply equally to Black medick.

Nutsedge, Yellow (Nut Grass)

Corn – Conventional

Preplant incorporated (PPI) applications of either DUAL II MAGNUM at 1.75 L/ha (0.7 L/acre) or FRONTIER MAX at 1.4 L/ha (0.56 L/acre) will suppress nutsedge growth. If either product is not applied PPI, nutsedge control will be reduced.
A postemergence application of PERMIT at 70–90 g/ha (28–38 g/acre) + non-ionic surfactant at 0.25% v/v) provides the best control of yellow nutsedge.

Expectation for control: 60%–80%

Corn – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") corn, nutsedge control with glyphosate is greatly affected by rate. A single application of glyphosate (360 g/L) applied at a rate of 5 L/ha (2 L/acre) will provide around 80% visual control of nutsedge whereas the 2.5 L/ha (1 L/acre) rate will typically provide less than 60% visual control A tank-mix of PERMIT at 47–90 g/ha (19–38 g/acre) + glyphosate (360 g/L) at 1 L/acre (2.5 L/ha) non-ionic surfactant at 0.25% v/v) provides the best control of yellow nutsedge.

Expectation for control: 70%–80%

Soybeans – Conventional

CLASSIC/CHAPERONE at 36 g/ha (14 g/ac) + non-ionic surfactant at 0.2% v/v applied postemergence has provided the best control of nutsedge in comparative trials. In fields with tremendous nutsedge pressure, some producers have opted to preplant incorporate either DUAL II MAGNUM or FRONTIER MAX at their highest labelled rate and then apply CLASSIC/ CHAPERONE postemergence in soybeans.

Expectation for control (with CLASSIC/ CHAPERONE): 90%

Soybeans – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") soybean, GUARDIAN (a co-pack of POLARIS + CLASSIC) applied postemergence to nutsedge has continually provided the best visual control.

A single application of glyphosate (360 g/L) applied at 5 L/ha (2 L/acre) will also provide control of nutsedge but consistently at 10%–20% less than GUARDIAN.

Expectation for control: 95%

Cereals

Typically not a huge problem in winter cereals since cereal growth will provide a level of competition that keeps nutsedge suppressed during the season. The majority of cereal herbicides provide little activity on nutsedge.

Sow-Thistle, Perennial

Corn – Conventional

In comparative trials postemergence applications of dicamba/atrazine (e.g., MARKSMAN) at 2.5 L/ha (1 L/acre), dicamba (e.g., BANVEL II) at 1.25 L/ha (0.5 L/acre) or DISTINCT at 285 g/ha (115 g/ac) + non-ionic surfactant at 0.25% v/v + 28% UAN at 5 L/ha (2 L/acre) and PEAK at 13.3 g/ha (5.3 g/ac) + non-ionic surfactant at 0.2% v/v. have all provided good control of perennial sow-thistle.

Expectation for control 80%–90% top growth control

Corn – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") corn, glyphosate (360 g/L) applied postemergence at 5 L/ha (2 L/acre) will provide good top growth control of perennial sow-thistle. It is not uncommon for perennial sow-thistle to re-grow after an application of glyphosate, therefore requiring follow-up applications. Tank-mixing glyphosate with dicamba/atrazine, dicamba or PEAK can deter perennial sow-thistle re-growth.

Expectation for control 85%–95% top growth control

Soybeans – Conventional

In comparative trials all postemergence soybean herbicides can periodically provide some level of perennial sow-thistle control however none do consistently. CLEANSWEEP, BLAZER at 2.5 L/ha (1 L/acre), BASAGRAN FORTE at 2.25 L/ha (0.9 L/acre) and CLASSIC + non-ionic surfactant at 0.2% v/v provide top growth control, but typically sow-thistle will re-grow and be present at harvest. Pre-harvest glyphosate applications will have more impact on reducing perennial sow-thistle populations than any in-crop herbicide.

Expectation for control: 50%–70% top growth control

Soybeans – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") soybean, glyphosate (360 g/L) applied postemergence at 5 L/ha (2 L/acre) will provide good top growth control of perennial sow-thistle. It is not uncommon for perennial sow-thistle to re-grow after an application of glyphosate, therefore requiring follow-up applications.

Expectation for control 85%–95% top growth control

Cereals

The challenge with perennial sow-thistle control in cereal crops is that the weed often emerges after the appropriate crop stage for herbicide applications. If emerged during the tillering to nodal stage of cereals, dichlorprop/2,4-D, TROPHY and MCPA Ester have provided good top growth control. The single most important management practice that a grower can implement to reduce perennial sow-thistle is to use either a pre-harvest glyphosate (360 g/L) application at 2.5 L/ha (1 L/acre) or with an application of glyphosate (360 g/L) at 5 L/ha (2 L/acre) after cereal harvest, typically in mid to late September, after perennial sow-thistle has re-grown. Both application timings will decrease the level of thistles to manage in the following spring. A pre-harvest application is preferred if perennial sow-thistle is at a population density that is problematic for harvesting.

Quackgrass

Corn – Conventional

Either OPTION 2.25 OD at 1.56 L/ha (0.63 L/acre), ULTIM at 33 g/ha (13 g/ac) + non-ionic surfactant at 0.2% v/v or ACCENT at 33 g/ha (13 g/ac) + non-ionic surfactant at 0.2% v/v applied postemergence to quackgrass will provide excellent control.

Expectation for control 90%–95% top growth control

Corn – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") corn, target actively growing quackgrass that is 10–20 cm in height with an application of glyphosate (360 g/L) at 2.5 L/ha (1 L/acre).

Expectation for control: 90%–95%

Soybeans – Conventional

If quackgrass has emerged before planting, a preplant burndown with glyphosate (360 g/L)at 2.5 L/ha (1 L/acre) should be made.

For quackgrass that has emerged in the soybean crop, postemergence applications of ASSURE II at 0.75 L/ha (0.3 L/acre) + SURE MIX at 0.5% v/v, VENTURE at 2 L/ha (0.8 L/acre) or POAST ULTRA at 1.1 L/ha (0.45 L/acre) + MERGE at 2 L/ha (0.8 L/acre) will provide suppression/control of quackgrass. ASSURE II has been the most consistent of the three in limited comparative trials.

Expectation for control 70%–85%

Soybeans – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") soybean, target actively growing quackgrass that is 10–20 cm in height with an application of glyphosate (360 g/L) at 2.5 L/ha (1 L/acre).

Expectation for control: 90%–95%

Cereals

There are no products available in cereals that will control quackgrass. The single most important management practice that a grower can implement to reduce quackgrass is to use either a pre-harvest glyphosate (360 g/L) application at 2.5 L/ha (1 L/acre) or an application of glyphosate after cereal harvest, typically in mid to late September, after quackgrass has re-grown. Both application timings will decrease the level of quackgrass to manage in the following spring. A pre-harvest application is preferred if quackgrass is at a population density that is problematic for harvesting.

Vetch, Tufted

Corn – Conventional

In comparative trials either dicamba (i.e. BANVEL II) at 0.625 L/ha (0.25 L/acre), DISTINCT at 285 g/ha (115 g/ac) + non-ionic surfactant at 0.25% v/v + 28% UAN at 5 L/ha (2 L/acre) or CALLISTO at 210 mL/ha (85 mL/acre) + AATREX 480 at 580 mL/ha (235 mL/acre) + non-ionic surfactant at 0.2% v/v have all provided good top growth control of tufted vetch.

Expectation for control: 80%–90%

Corn – Herbicide Tolerant

The 2.5 L/ha (2 L/acre) maximum rate of glyphosate listed for use in glyphosate tolerant ("Roundup Ready") corn has only provided 70% visual control of vetch in University of Guelph dose response trials. Tank-mixes of either CALLISTO + AATREX, dicamba/atrazine (e.g., MARKSMAN) or dicamba (e.g., BANVEL II) with glyphosate have provided the best level of vetch control in comparative trials. The combination packs (co-packs) of GALAXY 2 (glyphosate + ULTIM) have also provided good control of vetch.

Expectation for control: 85%–95%

Soybeans – Conventional

It is extremely difficult to control a perennial legume weed in an annual legume crop. Of all the herbicide programs tested over the past 10 years, a "two-pass" strategy of applying DUAL II MAGNUM + SENCOR premergence followed by REFLEX postemergence has provided the best suppression of vetch. If vetch has emerged prior to planting, University of Guelph research has shown that the addition of 2,4-D Ester 700 at 320 mL/acre (800 mL/ha) tank-mixed with glyphosate and applied 7 days prior to planting can provide good early season control of vetch.

Expectation for control: 50%–70%

Soybeans – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") soybean, the rate listed on the ROUNDUP WEATHERMAX (540 g/L) label of 4.67 L/ha (1.87 L/acre) for the control of volunteer alfalfa offers the best potential for vetch suppression/control. If vetch has emerged prior to planting, University of Guelph research has shown that the addition of 2,4-D Ester 700 at 800 mL/ha (320 mL/acre) tank-mixed with glyphosate and applied 7 days prior to planting can provide good early season control of vetch.

Expectation for control: 70%–80%

Cereals

The challenge with vetch control in cereal crops is that the weed often emerges after the appropriate crop stage for herbicide applications. If emerged during the tillering to nodal stage of cereals, TROPHY, 2,4-D Ester, MCPA Ester and dichlorprop/2,4-D have all provided some level of top growth control. Post harvest herbicide applications made before the first frost (vetch is sensitive to cold air temperatures and is one of the first species to die off in the fall) are advantageous in decreasing the level of vetch to manage in the following spring. In limited comparative trial work, glyphosate (360 g/L) at 5 L/ha (2 L/acre) tank-mixed with either DISTINCT at 285 g/ha (115 g/ac) or dicamba (i.e. BANVEL II & ORACLE) at 1.25 L/ha (0.5 L/acre) significantly reduced the amount of vetch that emerged the following spring and into the summer.

Waterhemp – Glyphosate Resistant

Corn

Control of glyphosate resistant waterhemp is best achieved with a two-pass herbicide program where one of CALLISTO + AATREX, CONVERGE, FOCUS, FRONTIER MAX or PRIMEXTRA II MAGNUM is applied preemergence. If a second flush of waterhemp emerges once the crop has emerged, then one of MARKSMAN, BANVEL II or CALLISTO + AATREX can be applied.

Soybeans

Control of glyphosate resistant waterhemp is best achieved with a two-pass herbicide program where one of BOUNDARY LQD, FOCUS, FIERCE, FRONTIER MAX or VALTERA is applied preemergence. If a second flush of waterhemp emerges once the crop has emerged, then one of REFLEX or BLAZER can be applied.

Wire-Stemmed Muhly

Corn – Conventional

OPTION 2.25 OD at 1.56 L/ha (0.63 L/acre) provides the best control.

Expectation for control 80%–95%

Corn – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") corn, target actively growing wire-stemmed muhly that is 10–20 cm in height with an application of glyphosate (360 g/L) at 2.5 L/ha (1 L/acre).

Expectation for control: 80%–95%

Soybeans – Conventional

If wire-stemmed muhly has emerged before planting, a preplant burndown with glyphosate (360 g/L) at 2.5 L/ha (1 L/acre) should be made. For wire-stemmed muhly that has emerged in the soybean crop, VENTURE at 2 L/ha (0.8 L/acre) will provide the best suppression/control of wire-stemmed muhly.

Expectation for control: 75%–95%

Soybeans – Herbicide Tolerant

In glyphosate tolerant ("Roundup Ready") soybean, target actively growing wire-stemmed muhly that is 10–20 cm in height with an application of glyphosate (360 g/L) at 2.5 L/ha (1 L/acre).

Expectation for control: 80%–95%

Cereals

There are no products available in cereals that will control wire-stemmed muhly. The single most important management practice that a grower can implement to reduce this weed is to use either a pre-harvest glyphosate (360 g/L) application at 2.5 L/ha (1 L/acre) or an application of glyphosate after cereal harvest, typically in mid to late September, after wire-stemmed muhly has re-grown. Both application timings will decrease the level of wire-stemmed muhly to manage in the following spring. A pre-harvest application is preferred if wire-stemmed muhly is at a population density that is problematic for harvesting.

2. APPLICATION TECHNOLOGY

Introduction

Herbicide application should be a precision operation. Recent advances in equipment and control systems can make the job relatively simple and precise.

Pesticides applied incorrectly may result in wasted pesticide, poor or no control, damage to crops (possibly the neighbour's) or environmental contamination. Every effort must be made to apply chemicals properly.

Developments in New Equipment

In building sprayers that accurately apply herbicides, equipment manufacturers work closely with the crop-protection industry. Innovations, such as closed-injection systems with herbicide concentrate carried separately from the water carrier, are now in use. Electronic rate controllers provide more accurate spray application by utilizing speed sensors, flow controllers and microprocessors to maintain the desired application rate. This technology has also included radar to accurately sense true ground speed of the sprayer. Rate controllers are commonly used by professional applicators. GPS guidance control systems with possible auto steer allow sprayers to cover the field with minimal overlap swath to swath. This allows for complete field spray coverage while not double applying product in certain areas.

The industry is currently working towards the closed-injection system. Work continues in the area of drift reduction using air assist and electrostatic spray methods.

Air-induction nozzles significantly reduce spray drift and are available in a range of sizes from a number of suppliers. Operating these nozzles within their working pressure range is crucial to ensure designed spray angle development, proper air induction into the nozzle and necessary droplet size for the job at hand. Before buying air induction spray tips, make sure your sprayer pump can produce sufficient pressure to operate these tips under all conditions. Check with the nozzle manufacturers for operating pressures required. Most nozzle manufactures a variety of air induction nozzles including both low-pressure and high pressure designs.

Field Sprayers

The most common type of sprayer used in herbicide application is the boom sprayer. This sprayer applies a uniform amount of spray solution across the width of the boom.

The main requirements for field spraying are:

- uniform pressure across the whole boom
- all nozzles have the same output and a good spray pattern
- a constant forward speed in actual field conditions
- ability to adjust boom height so that the required nozzle – to – target height can be achieved
- a stable boom height to ensure proper overlap of the nozzle-tip patterns

Most commercially built sprayers can be adapted and used safely to apply liquid fertilizers. Extra agitation may be required. Ensure that the sprayer components being used will resist the corrosive nature of some fertilizer formulations and follow the manufacturer's recommendations.

Air-Blast or Mist Sprayers

These machines should never be used to apply herbicides, especially hormone-type herbicides such as 2,4-D. The danger of causing off-target crop injury at a great distance from the treated area is very high.

Wiper Applicators for Selective Weed Control

Wiper applicators (rope-wick, roller applicator or similar devices) containing glyphosate can be used when the target weeds are taller than the crop so as to avoid contact with a crop sensitive to that herbicide. Other products may exist that can be wick applied. Refer to intended product labels for use of this application technique. The main criteria for using wiper applicators are:

- contact enough of the target plant to get herbicidal effectiveness
- keep the wick application above the crop to avoid crop injury

Travel speeds should be 4–10 km/h for wick application. Two passes in opposite directions may be beneficial, especially in heavy weed infestations and where higher vehicle speed is contemplated. Care must be taken not to contact sucker growth in orchards, vineyards and shelterbelts. This may result in crop injury.

Care and Use of Equipment

Spraying Speeds

Since herbicides must be uniformly applied, the forward speed of a sprayer must be constant whenever the nozzles are delivering liquid. If the driving wheels of a tractor slip on the soil surface, the tractor's speedometer does not indicate a change in forward speed. To be certain that the forward speed is constant in spite of wheel slippage on hills, or loose soil, use an independent speedometer powered by a non-driven wheel or use newer radar or GPS speed sensors. Spray monitors and other electronic rate controllers also may be installed. Only rate controllers will automatically adjust for variation in tractor speed to maintain a constant rate of application.

Water

Use only clean water that contains no debris, soil or organic matter. On your farm water supply, use a frost-free water hydrant located outside a building. An anti-backflow or anti-siphon valve should always be installed on any hydrant or water supply. Never allow the suction screen to rest on the bottom of a farm pond while filling a sprayer. The intake line near the screen must, by law, be equipped with a spring-loaded check valve or anti-backflow device to prevent contamination of the pond or stream when the pump is shut off. Tank-refilling nozzles, volume-booster nozzle or injection pumps should not be used to refill the sprayer tank from farm ponds or streams. These tank-refilling aids may cause pond or stream contamination.

Agitation

When chemical formulations in solution are used (e.g., 2,4-D and water) at least 2–14 L of spray solution should be returned to the tank each minute to provide adequate agitation. Higher rates will apply with wettable powders. To be effective, the agitation line from the pump should pass through a control valve and deliver the liquid to the bottom (not the top) of the tank. Agitation propellers, agitation nozzles or a sparge tube should always be used to ensure sufficient liquid circulation in the tank.

When wettable powder herbicides are used, the return to the tank should be 14–27 L/min for each 450 L of tank capacity. A dedicated line from the pressure side of the pump (not the pressure regulator) to the tank must be used to supply the liquid necessary for hydraulic agitation in the tank. Always use a venturi jet or sparge tube. This flow can be reduced if the sprayer has a mechanical agitator. Sparge tube agitation requires more water than venturi nozzles to give the same agitation.

Avoid excessive agitation of the mixture, as it may turn into an invert immulsion, a grease-like mass that will settle to the bottom of the tank and cannot be pumped. Excessive agitation may also cause foaming resulting in pumping problems. To prevent a build-up of oil in the sprayer, the tank should be emptied completely before refilling. After any break in the spraying operation, agitate thoroughly before resuming operation. Immediately after use, clean the tank and sprayer with a detergent or solvent and flush with clean water.

Pumps

The pump is the most important part of the sprayer and should have adequate capacity to maintain the desired pressure, volume and agitation. Piston, diaphragm and centrifugal pumps are best for pumping wettable-powder suspensions. For liquid herbicide applications, roller pumps may be used in addition to the above types. When used for wettable powders or flowable formulations, choose a pump with an abrasion resistant housing. Carefully follow the manufacturer's care and storage instructions for the best pump performance.

CAUTION: Running a spray pump without water may cause damage or premature wear.

Nozzle Tips

Numerous companies make spray nozzles. Nozzles from different suppliers may be similar in design but may differ in setup requirements. Always follow manufacturer's recommendations for nozzle spacing and nozzle-to-target distances. These distances may vary according to the spray angle of the nozzle. Proper spacing and orientation of nozzles is essential to ensure adequate overlap of adjacent nozzle spray plumes.

Care should be taken to maintain a stable boom height to ensure uniform overlap of the nozzle spray patterns.

The success of the spray application is dependent in part on the condition of the nozzle tips and the uniformity of application across the whole spray boom. The spray pattern of all nozzles should be examined prior to their use. In addition, every nozzle should be checked when calibrating the sprayer.

Materials used for nozzle tips range from brass, stainless steel, hardened stainless steel, as well as plastics/polymers and ceramics. All product formulations and carriers cause wear of the nozzle orifice. Wettable powders cause abrasive wear, more than other formulations.

Sprayers should be calibrated regularly. (See *Care and Use of Equipment*, "Sprayer Calibration" on page 15).

Nozzle tips should be replaced when they deliver 10% more than manufacturer's rated output specifications or when their distribution pattern becomes unacceptable.

Flat fan nozzles are widely used on boom sprayers to apply herbicides. Spray operating pressures should be within limits specified by the nozzle manufacturer. Nozzles with a 110 degree spray angle have more overlap than 80 degree nozzles. This allows less chance of spray skips as the boom moves closer to the ground. Always follow manufacturer's recommendations for spacing minimum nozzle to target distance and spray operating pressures.

Air induction or venturi nozzles are now available from at least a dozen different suppliers. These nozzles were specifically designed to reduce the amount of fine droplets produced in the smaller nozzle sizes. The nozzle manufacturers offer air induction or venturi nozzles in a wide range of sizes.

These nozzles draw air into the nozzle as the spray liquid passes through the nozzle venturi. The result is a coarser spray with very few fine spray droplets that are prone to drift. These coarse droplets contain air bubbles that cause the droplets to rupture upon impact with plant surfaces.

Air induction nozzles are made in two pressure ranges, low pressure and high pressure. If a sprayer cannot exceed 345 kPa, only consider a low pressure design. All venturi nozzles should be operated in the middle of their working range. For the low pressure designs this is approximately 275 kPa and in the high pressure designs, about 550 kPa. All venturi nozzle designs are extremely sensitive to low working pressure. The spray patterns will collapse to less than their designed spray angle if the nozzle pressure is too low. In addition, the induction of air into the spray liquid will not occur if the pressure goes below the operating range of the nozzle.

Many producers have quickly adopted this new nozzle technology. The significant reduction in spray drift, compared to conventional flat fan nozzles, is a welcome feature. See Figure 2–1. *Conventional vs. Air Induction Nozzles,* on this page. Some producers are using these nozzles for all their herbicide spraying.

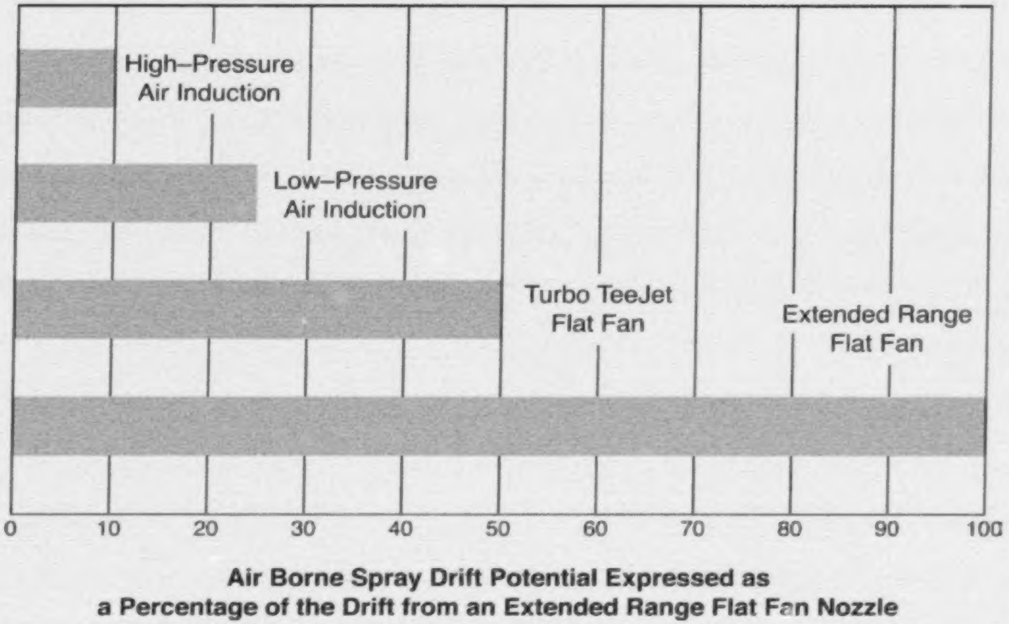

FIGURE 2–1. Conventional vs. Air Induction Nozzles.

Some product performance problems have occurred when air induction or venturi nozzles have been used. Poor timing of spray, reduced water volumes, spray pressures that are too low and difficult-to-wet weeds may all contribute to poor control.

Special "even flat fan" spray nozzles are available for band spraying of herbicides. These even flat fan nozzles deliver a uniform amount of spray over their sprayed area. A variety of sizes, spray angles and nozzle materials are available. The nozzle-to-target height, and spray angle of the nozzles as well as their orientation to the direction of travel, determines the width of the sprayed band. Carefully follow the manufacturer's literature and directions.

Flooding nozzle tips are used at low pressures and, because of their wide spray angle, can be used closer to the ground surface, thus reducing the potential for drift. New flooding nozzle tip designs have improved the spray distribution patterns to the point that it is as good as with the flat fan tips. Flooding nozzle tips are available in brass, plastic/polymers and stainless steel. Half as many of these nozzle tips are required to cover the same width as would be required with flat fan nozzles.

Full or hollow cone nozzle tips may be used for applying herbicides to the soil surface when the herbicide is mixed into the soil with a disk harrow, cultivator or similar tillage implement.

NOTE: When using any nozzle for spraying wettable powders or micro-nutrients, it is essential to calibrate the sprayer frequently because, as a nozzle wears, the quantity of spray material delivered increases and distribution is uneven. Worn nozzles usually result in a poor spray pattern.

Nozzle manufacturer's catalogues will list screens required for various nozzle types and sizes. Diaphragm check valve nozzle bodies will ensure dripless operation when the boom is turned off. To clean nozzle screens, remove them from the nozzle bodies and wash thoroughly with soap and water, using a nozzle tip brush. Simply flushing water through the boom and nozzles will not remove pesticide residue that has built up on the outside of the nozzle screens.

Cleaning the Sprayer

Before cleaning the sprayer, dispose of surplus tank mix. As suggested in the Grower Pesticide Safety Course, one method of disposal is to dilute the remaining spray solution at least 10:1 with water. This diluted solution can be applied to the previously treated area as long as the maximum labelled product rate is not exceeded.

Clean out the sprayer immediately after finishing the day's work or when changing chemicals. At the end of each spray day, thoroughly flush out the boom with plenty of water to rinse lines, diaphragm check valves and nozzles. Delaying cleanout, even overnight, can allow the formation of hard-to-remove deposits. The sprayer tank is much more difficult to clean out, if it is allowed to dry. Don't forget to also clean out the measuring containers.

Steps

1. Read the product label to determine the recommended cleaning procedure. Have all the materials required for the cleanup ready, including appropriate personal safety equipment.
2. Drain the spray tank.
3. Fill the tank with water and add detergent, ammonia or other tank cleaner product and agitate for 10–20 minutes (clean the whole tank not just the bottom half). Flush boom and hoses with solution, allow to stand for several hours (or overnight if possible) and then flush boom and nozzles again and drain the tank. When flushing the boom, open the boom ends to get particles out of the boom.
4. Inspect the inside of the tank for visual residues. Rinse the inside of the tank if necessary. Repeat step 2.
5. Wash the outside of the sprayer with soap or mild detergent and water.
6. Remove nozzles, screens, and wash separately in a bucket containing cleaning solution. Wash out measuring containers with the cleaning solution.
7. Remove all boom end plugs or caps. Product residues collected in the ends of the various boom pipe sections could cause crop injury. Thoroughly clean out the plugs or caps and pipe ends with cleaning solution. Carefully replace all the boom end plugs or caps.

Thoroughly rinse the tank, hoses, booms, nozzles and screens with clean water for a minimum of 10 minutes. Repeat immediately before the next use.

Use household detergent at rate of 250 mL/100 L or 1 kg/150 L of water. Use ammonia (3%) at 1 L/100 L of water. Use other cleaning agents according to label directions. Never mix ammonia with chlorine bleach. Chlorine gas is produced which may cause severe eye, nose, throat, or lung irritation.

NOTE: Contact the manufacturer of pesticides being used to determine the best methods and product(s) to clean residue from tanks and associated equipment. Read the label, since many products provide specific tank-cleaning information on their label.

When surfactants or fertilizer solutions (e.g., AGRAL 90, 28% UAN) are used in a labelled mix with herbicides, there may be some inadvertent cleaning of previous residues from the tank/equipment that could affect the crop. Proper cleanout when changing products is essential to prevent crop injury.

The wash water contains herbicide. Never allow wash water to run into a well, lake, pond, river or other water source.

Do not leave puddles of herbicide solution, tank cleaning or rinse water that may be accessible to children, pets, farm animals or wildlife.

Sprayer Calibration

Field Boom-Type Sprayer Calibration

(Determining application rates in L/ha).

There are many ways of determining the rate of spray material that is being applied to 1 ha of land.

Instructions

1. Measure the time.
    - Place 2 stakes 50 m apart in the field.
    - Select the gear and throttle setting (rpm) at which you plan to spray. Half-fill the sprayer with water.
    - Drive the distance between the stakes three times, timing each pass. Each time, make sure the tractor is at the desired speed as you pass the first stake. Continue driving at this speed until you pass the second stake.
    - Note the average time of the 3 passes.
2. Measure the average nozzle output.
    - Park the sprayer with the PTO engaged and the throttle adjusted to reach the PTO speed set in the test run.
    - Adjust the pressure regulator to the desired working pressure with full flow to the boom.
    - Collect the output from each nozzle for the average length of time needed to travel the 50 m in the test run.
    - Enter the nozzle outputs into the equation below.
    - If any nozzle is more than 10% above or below the average output, it should be cleaned, re-tested and if still 10% off, be replaced.
3. Measure the nozzle spacing in metres.
4. Use the following formula to determine the sprayer output:

$$\text{Sprayer Output (Litres/hectare)} = \frac{\text{Average Nozzle Output (mL)}}{\text{Nozzle spacing (metres)}} \times 0.2$$

5. Calculate the area sprayed per full tank of spray solution. Re-check the sprayer calibration after each tank of spray is applied by dividing the volume sprayed by the area sprayed. The nature of some products may slightly alter the calibration from that of clean water.
6. Growers who are more comfortable with litres/acre or gallons/acre can use the following conversion guide.

Litres/hectare × 0.4 = L/acre
Litres/hectare × 0.09 = Imp. gal/acre
Litres/hectare × 0.11 = U.S. gal/acre

Sample Calculation

Average time to travel 50 m (164 ft) = 24.5 sec
Average amount of liquid collected per nozzle for 24.5 sec = 525 mL
Nozzle spacing on the boom = 0.5 m (» 20 in.)

$$\text{Application rate} = \frac{525 \text{ mL}}{0.5 \text{ m}} \times 0.2 = 210 \text{ L/ha}$$

210 L/ha × 0.4 = 84 L/acre
210 L/ha × 0.09 = 18.9 Imp. gal/acre
210 L/ha × 0.11 = 23 U.S. gal/acre

Band Spraying: The same formula can be used to calibrate when banding. Instead of using nozzle spacing in metres, use width of area sprayer per nozzle in metres.

NOTE 1: Sprayer-calibration bottles or kits are available from a number of suppliers. For further information contact your local office of the Ontario Ministry of Agriculture, Food and Rural Affairs or manufacturers of sprayers, sprayer parts or herbicides.

NOTE 2: For banded-spray applications, measure the width of the spray band (at the soil surface or surface of the crop canopy) and enter this value into the formula instead of the "nozzle spacing". Note that in band spraying the acreage sprayed is **not** the same as the crop acreage. (When broadcast spraying a row crop with 1 m rows, the whole field is treated. A band spray may only treat 30 cm over each row. Therefore, only about 1/3 of the field is actually treated.) The herbicide rates referred to in most herbicide publications and labels refer to the actual area sprayed unless otherwise stated.

Hand-Held/Backpack Sprayer Calibration

Many people use small hand-held or backpack sprayers for treating problem areas or spraying areas that were missed. Calibration of these sprayers is as important as calibrating your field sprayer.

Method I

1. Measure an area that is 100 m^2.

   e.g., 10 m × 10 m, or 25 m × 4 m

2. Fill the spray tank with water. Mark the level on a measuring stick. Pump to the pressure that will be used during the pesticide application.
3. Spray the water over the 100 m^2 area. Walk at a steady pace, taking care to apply it as evenly as possible, just as you would when applying pesticide.

4. Measure the amount of water needed to refill the spray tank to the mark on the measuring stick. This amount will be the sprayer output per 100 m^2.

Method II

1. Set 2 stakes 50 m (164 ft) apart in the field.
2. Half-fill the sprayer with water.
3. Walk the 50 m three times at a steady pace. Calculate your average time to travel the 50 m.
4. Measure the width of the band sprayed by the nozzle (in metres) at your walking pace.
5. Pump the sprayer for the same amount of time as calculated in step #3, collecting the liquid from the nozzle in a measuring device.
6. Application rate (L/ha)=

$$\frac{\text{mL liquid per nozzle}}{\text{Band width (metres)}} \times 0.2$$

Method III

1. Partially fill sprayer. Pump to the pressure you will use during the pesticide application.
2. Spray to determine width of swath (in metres).
3. Walk at a steady pace for 15 seconds. Measure the distance (in metres).
4. Multiply spray width times distance travelled to provide the area (in square metres) sprayed in 15 seconds.
5. Spray into a measuring device for 15 seconds – gives amount of solution sprayed in 15 seconds.
6. Application rate (L/ha) =

$$\frac{\text{amount sprayed}}{\text{area (length} \times \text{width)}} - \frac{\text{L} \times 10{,}000}{\text{sq. metres}}$$

To convert the application rate of any pesticide to the amount required for a small area, follow this guide:

- 1 kg/ha = 10 grams/100 m^2
- for liquid measure, 100 L/ha = 1 L/100 m^2

(Source: Ontario Pesticide Education Program Manual 1995).

Determining Amount of Herbicides Needed

Determining Amount of Product per Hectare

Most rates suggested in this publication are given in terms of both active ingredients (common name) per hectare and product (TRADE NAME) per hectare. However, where the amount of active ingredient in the formulations varies considerably (for example, glyphosate is available in concentrations of 360 g/L, 480 g/L, 500 g/L and 540 g/L) The rate may be given in terms of active ingredient only.

> **NOTE:** Throughout this publication, the common name of each herbicide (its active ingredient) is printed in italicized lowercase letters (e.g., atrazine, dicamba), whereas the product trade name (the name of the liquid or powder etc., inside the container as supplied by the manufacturer) is printed in capital letters (e.g., AATREX, BANVEL II), and its formulation is listed within brackets following the trade name.

Determining Amount of Product Required per Tankful

After determining how much commercial product is needed per hectare, calibrate the sprayer and determine the number of hectares each tank will cover. Determine the quantity of herbicide needed to add to the spray tank using the following formula:

Area covered per tankful =
sprayer tank size (Litres)/Application Rate (L/ha) =
hectares

Product required/tank =
hectares covered by tank × product rate/ha

Sample Calculations

(a) product/tank = 4.1 ha × 2.2 kg/ha
= 9.02 kg LOROX/tank

(b) product/tank = 4.1 ha × 2.1 L/ha
= 8.61 L AATREX/tank

Follow manufacturer's recommendations on mixing order and procedures.

Materials, Mixing and Mixtures

Dry herbicide formulations include granules, soluble powders and wettable powders. Granules do not require prior mixing into a slurry. They are ready to be mixed in water. Soluble powders can be dissolved in water. Wettable powders will not dissolve but will form a suspension that requires constant agitation.

Liquid herbicide formulations either mix in water to form a solution or may be oil-based and form an emulsion that will require agitation.

Pesticide labels usually provide mixing directions for registered tank-mixes, often describing the order of mixing. Whenever a label provides mixing directions, they should be followed. Consult the package labels for information on the compatibility of different herbicide products as certain formulations may react when mixed together, resulting in materials with different properties and activities than the original ones. If the pH or hardness of the water requires adjustment, adjustments should be made prior to the addition of spray material to the tank.

When the label does not provide mixing instructions for a registered tank-mix, pesticides should generally be mixed using the following procedure:

- Fill the spray tank with water to ½ of the total spray volume required and start agitation. Add the different formulation types in the order listed below, allowing time for complete mixing and dispersion after adding each product.

    1. dissolvable packs
    2. wettable powders
    3. water dispersible granules and dry flowables

- Maintain agitation and fill spray tank to ¾ of total spray volume. Then add:

    4. water-based solutions
    5. emulsifiable concentrates
    6. spray adjuvants

- Finish filling the spray tank to the required volume, Maintain continuous agitation during mixing and final filling, and throughout application.

Mixtures of different herbicides or mixtures of herbicides with pesticides or foliar fertilizers should not be applied in a single application unless registered for use in this way.

Unless specifically mentioned in this publication, or on a herbicide label, the addition of a surfactant or a detergent to a spray solution is not recommended.

Where water is known to have an excessive salt content, compatibility of the water and the chemical at field strength should be tested first on a small scale. See note on *Agitation* in the *Care and Use of Equipment* section, page 12.

Application Indicators

Colourants/Foam Markers for Pesticides Application

Colourants added to the pesticide solution help show where pesticides have been applied. Foam marking systems help minimize overlap. Adding a colourant to the basal sprays of herbicides on cut stumps of woody plants helps assure thorough coverage without respraying. Examples of colourants are listed below.

- Blazon: blue, water soluble
- Bas-oil Red : red, oil soluble
- Red Dye Foam

Colourants are available from agricultural chemical dealers.

Additional Information

Video

- *How to Manage Spray Drift*
- *Spray Drift Reduction Through Air Induction*
- *Field Sprayer Calibration*

Available from:

Ontario Pesticide Education Program
Phone 1-800-652-8573
www.opep.ca

OMAFRA Factsheets

- *Six Elements of Effective Spraying in Orchards and Vineyards*
- *How Weather Conditions Affect Spray Applications* (web only)
- *Ways to Avoid Pesticide Spills*
- *Calibrating Airblast Sprayers*
- *Adjusting, Maintaining and Cleaning Airblast Sprayers*
- *Pesticide Contamination of Farm Water Sources*
- *Pesticide Drift from Ground Applications*
- *Farm Pesticide Storage Facility*

Pesticide Drift

Do you know what pesticide drift looks like or what you can do about it? OMAFRA and CropLife Canada have created two short videos with innovative visual demonstrations using dyes and night-spraying to show what drift actually looks like. See how spray particles behave and discover what changes can be made to your spray program to greatly reduce the risk of pesticide drift. Learn more at ontario.ca/spraydrift.

3. USING PESTICIDES IN ONTARIO

The information in this chapter is updated regularly. For up-to-date information, visit ontario.ca/usingpesticides. Some of the information in this generic chapter may not apply to all crops.

Read the label before use.

Product labels may change.

Review the Grower Pesticide Safety Course Manual.
www.opep.ca/index.cfm/learning-resources/e-manuals/

Keep detailed spray records.

Federal Registration of Pesticides

Before a pesticide can be sold or used in Ontario, it must be registered under the federal *Pest Control Products Act* (PCP Act) and be classified under the provincial *Pesticides Act*. The Pest Management Regulatory Agency (PMRA) of Health Canada registers pesticides for use in Canada following an evaluation of scientific data to ensure that the product has value. It also ensures that any human health and environmental risks associated with its proposed uses are acceptable.

The PMRA re-evaluates registered pesticides to determine whether today's health and environmental protection standards are still met when the pesticide is used according to the label. Outcomes of a re-evaluation can be:

- no change to the registration
- amendments to the label (e.g., changes to personal protective equipment requirements, restricted entry intervals, buffer zones)
- modifications to existing Maximum Residue Limits (MRLs)
- elimination or phasing-out of certain uses or formulations
- discontinuation of the registration

The pesticide label is a legal document. Follow all label directions. Labels for all registered pesticides are under "Search Pesticide Labels" on the PMRA website at www.healthcanada.gc.ca/pmra. Ensure you have the most current label and are aware of any re-evaluation decisions.

Regulation of Pesticides in Ontario

The Ministry of the Environment and Climate Change (MOECC) is responsible for regulating the sale, use, transportation, storage and disposal of pesticides in Ontario. Ontario regulates pesticides by placing appropriate education, licensing and/or permit requirements on their use, under the *Pesticides Act* and Regulation 63/09. All pesticides must be used in accordance with requirements under the *Pesticides Act* and Regulation 63/09, which are available on the e-laws website at ontario.ca/e-laws or by calling ServiceOntario at 1-800-668-9938 or 416-326-5300.

Classification of Pesticides

Before a federally registered pesticide can be sold or used in Ontario, it must be classified under the provincial *Pesticides Act*. The Ontario pesticide classification system consists of 12 classes. Ontario's Pesticides Advisory Committee (OPAC) is responsible for assessing new pesticide products and recommending to the MOECC the classification of these products. Pesticide products are classified on the basis of their toxicity, environmental and health hazard, persistence of the active ingredient or its metabolites, concentration, usage, federal class designation (e.g., domestic, commercial, restricted) and registration status. The provincial classification system provides the basis for regulating the distribution, availability and use of pesticide products in Ontario. Once approved by the MOECC, classified products are posted on the MOECC website at ontario.ca/pesticides.

Certification and Licensing

Certified Farmers and Their Assistants

Growers must be certified through the Grower Pesticide Safety Course in order to buy and use Class 2 and 3 pesticides on their farms. They do not require this certification to buy and use Class 4, 5, 6 or 7 pesticides however, a grower needs to provide his/her Farm Business Registration Number or a signed "Farmer Self Declaration to Enable Purchase of a Class 4 Pesticide" form to the vendor when buying Class 4 pesticides. For information about certification for growers and training for assistants to growers, visit the Ontario Pesticide Education Program website at www.opep.ca or call 1-800-652-8573.

Class 12 Requirements for Growers

Starting on July 1, 2015, new requirements will be phased in for growers who plan to purchase or plant neonicotinoid-treated corn (silage or grain) or soybean seed in Ontario. For more information on the training and reporting requirements for growers, visit the MOECC website at ontario.ca/pesticides, then click on "Neonicotinoid regulations".

Commercial Applicators (Exterminators) and Their Assisting Technicians

For more information about exterminator licensing and technician training, visit:

- the Ontario Pesticide Training and Certification website at ontariopesticide.com or call 1-888-620-9999 or 519-674-1575
- the Pesticide Industry Council's Pesticide Technician Program website at www.horttrades.com/pesticide-technician or call 1-800-265-5656 or email pic@hort-trades.com
- the Pesticide Industry Regulatory Council (PIRC) at www.oipma.ca

Exception Uses under the Cosmetic Pesticide Ban

Pesticides listed in this publication are meant for Exception Uses (e.g., agriculture) under the Cosmetic Pesticide Ban unless the active ingredient is listed under Class 11 pesticides in Ontario Regulation 63/09.

For information about requirements under the *Pesticides Act* and Regulation 63/09, for golf courses and other excepted uses for turfgrass, including mandatory golf course IPM accreditation, go to ontario.ca and search for:

- Pesticides and Golf Courses
- Specialty Turf and Specified Sports Fields

For more information about requirements in the *Pesticides Act* and Regulation 63/09 for the exception regarding the use of pesticides to maintain the health of trees, go to ontario.ca and search for:

- Tree Care Specialists

For more information about pesticide regulations, certification and licensing, see:

- Inside front cover of this publication
- Pest Management Regulatory Agency (PMRA) website: www.healthcanada.gc.ca/pmra
- PMRA Pest Management Information Service: 1-800-267-6315 or TTY 1-800-465-7735 (from within Canada) or 1-613-736-3799 (from outside Canada)
- Ontario Ministry of the Environment and Climate Change (MOECC) website: ontario.ca/pesticides
- Regional MOECC Pesticides Specialist (See Appendix E. *Ministry of the Environment and Climate Change – Regional Contact Information*, on "APPENDIX E. Other Contacts" on page 452.)
- Ministry of Agriculture, Food and Rural Affairs (OMAFRA) website: ontario.ca/omafra
- Ontario Pesticide Education Program (University of Guelph, Ridgetown Campus) website: www.opep.ca
- Ontario Pesticide Training & Certification website: www.ontariopesticide.com
- Pesticide Industry Council's Pesticide Technician Program website at www.horttrades.com/pesticide- technician
- IPM Council of Canada website: www.ontarioipm.com or www.ipmcouncilcanada.org
- Pesticide Industry Regulatory Council (PIRC) at www.oipma.ca

Pesticide Application Information

When you decide to use a pesticide, choose the most appropriate formulation and application method for your situation. Use only properly calibrated sprayer equipment. Choose less toxic and less volatile alternatives when possible. Take all possible precautions to prevent the exposure of people and non-target organisms to the pesticide. Read the most current pesticide label thoroughly before application. The label provides important information, such as:

- directions for use (e.g., rates of application, crops/sites it can be used on, target pests, crop rotation restrictions, total number of applications, droplet size/nozzle type, application equipment, timing, appropriate weather conditions)
- required personal protective equipment (PPE)
- hazard symbols and warnings
- restricted entry intervals
- pre-harvest intervals
- buffer zones
- precautionary statements
- steps to be taken in case of an accident
- disposal

For more information on hazards, consult the Material Safety Data Sheet (MSDS) or contact the manufacturer.

For more information on pesticide application, see:

- Sprayers 101 - www.sprayers101.ca
- OMAFRA Factsheet *Pesticide Drift from Ground Applications*
- Ontario Pesticide Education Program (University of Guelph, Ridgetown Campus) videos at www.opep.ca/index.cfm/learning-resources/videos/
- OMAFRA Agriculture and Agri-Food Canada booklet *Best Management Practices — Pesticide Storage, Handling and Application*, Order No. BMP13
- OMAFRA Factsheet *Pesticide Contamination of Farm Water Supplies — Recommendations on Avoidance, Cleanup and Responsibilities*

Restricted Entry Intervals

Restricted Entry Interval (REI) is the period of time after a pesticide has been applied that agricultural workers or anyone else must not do hand labour tasks in treated areas. The REI allows the pesticide residues and vapours to dissipate to safe levels for work to be done.

An REI can range from 1 hr to several days. A pesticide label may state different REIs that are specific to a crop and post application task (e.g., scouting, harvesting). If the REI is not stated on a label for agricultural crops, use a 12-hr REI. For golf courses and residential turf applications, the spray solution must be dry before entry can occur.

Hand labour tasks involve substantial worker contact with treated surfaces such as plants, plant parts or soil. Examples of these activities include planting, harvesting, pruning, detasseling, thinning, weeding, scouting, topping, sucker removal, mowing, roguing, and packing produce into containers in the field or greenhouse. You can only do these tasks after the REI has passed. Hand labour generally does not include operating, moving or repairing irrigation or water equipment, except for hand-set irrigation.

A Certified Farmer or Licensed Commercial Applicator (i.e., a holder of the appropriate Exterminator License, such as an Agriculture Exterminator Licence or a Greenhouse/Interior Plant Exterminator Licence) may need to re-enter a treated area to do short-term tasks before the end of the REI. In these cases, the Certified Farmer or Licensed Commercial Applicator may re-enter 4 hr after the application wearing a NIOSH-approved respirator and any other protective clothing (PC) and the personal protective equipment stated on the label for mixing and loading. This Certified Farmer or Licensed Commercial Applicator (exterminator) must not be in the treated area during the REI for more than a total of 1 hr in any 24-hr period.

See Figure 3–1 for an example of a 24-hr REI on a pesticide label.

0 to 4 hours	4 to 12 hours	12 to 24 hours	24 + hours
• **Do Not Enter**	• **Early Re-Entry by Certified Farmer**	• **Early Re-Entry by Workers**	• **Enter**
• The end of the application is the start of the 24-hr Restricted Entry Interval. • No one may enter the treated area.	• Must not do hand labour tasks. • Must only be in the area for <1 hr in 24 hr. • Wear the PC & PPE stated on the label for mixing PLUS wear a NIOSH-approved respirator.	• Must not do hand labour tasks. • Must not contact any surfaces that may have residues. • Wear PC & PPE items if stated on the label for early re-entry.	• End of REI on a label with a re-entry from 24 hr to several days. • Anyone may enter.

Figure 3–1. Example of a 24-hr REI on a pesticide label.

Certified Farmers and Licensed Commercial Applicators should plan pesticide applications around work tasks so that no one needs to re-enter treated areas before the restricted entry interval has passed.

Days to Harvest Intervals for Food Crops (Pre-harvest, Pre-grazing and Feeding Intervals)

These intervals state the minimum time that must pass between the last pesticide application and the harvesting of the crop or the grazing and cutting of the crop for livestock feed. If you harvest a crop before the pre-harvest interval (PHI) has passed, there may be pesticide residues in excess of the maximum residue limits (MRLs) set by PMRA.

"Up to the day of harvest" means the same as 0 days PHI; however, the REI may be more restrictive (e.g., a 12-hr restricted entry interval) and must be observed for harvesting that occurs on the day of pesticide application.

To avoid exceeding the maximum residue limits, always follow the directions on the label.

Buffer Zones

Buffer zones, or no-spray areas, are areas left untreated to protect an adjacent sensitive area, such as sensitive terrestrial and aquatic habitats. Generally, a buffer zone is the downwind distance separating the point of direct pesticide application from the nearest boundary of a sensitive habitat. For soil fumigation, a buffer zone is an area established around the perimeter of each application block.

Leave a suitable buffer zone between the treatment area and adjacent sensitive area. Buffer zones may vary depending on the method of application (e.g., aerial, field boom, air blast). Check the pesticide labels for buffer zone requirements.

Sensitive terrestrial habitats include hedgerows, grasslands, shelterbelts, windbreaks, forested areas and woodlots.

Sensitive freshwater habitats include lakes, rivers, streams, creeks, reservoirs, marshes, wetlands and ponds.

Health Canada's PMRA has an online spray drift calculator that allows applicators to modify the buffer zones specified on the product label based on weather conditions, the category of the spray equipment and the droplet size. For more information, see the Buffer Zone Calculator at www.hc-sc.gc.ca/cps-spc/pest/agri-commerce/drift-derive/calculator-calculatrice-eng.php.

Setback Distances for Water Bodies

It is an offence under the federal *Fisheries Act* to introduce into water any material that may be harmful to fish or fish habitat, and under the *Species at Risk Act*, to impact endangered or threatened fishes and fresh water mussels. To protect these waters, applicators must determine a suitable setback distance between the area to be protected and the area where pesticide treatments are planned (if the setback distance is not specified on the pesticide label). The protected area includes the water body as well as adjacent riparian (riverbank) areas that contribute to fish food and habitat.

Protect the Environment

Protect Water Sources

According to the British Crop Protection Council (BCPC), 40%–70% of surface water pesticide contamination comes from mixing and filling areas.

Where possible, load or mix pesticides on impermeable surfaces located safely away from watercourses or environmentally sensitive areas. Collect drainage and run-off and dispose of it safely (*Your Guide to Using Pesticides*, BCPC 2007).

Clean your spray equipment away from wells, ponds, streams and ditches. Apply the diluted rinse water (usually at a ratio of 10:1) to the treatment area (crop), but do not exceed the pesticide rate recommended on the label.

Do not make a direct connection between any water supply (e.g., public supply, wells, watercourse or pond) and a spray tank. Use an anti-backflow device or intermediate system to prevent back-siphoning that could contaminate the water supply.

Immediately contain and clean up any spills to prevent contamination to water sources.

Check the pesticide label for specific instructions on protection of water sources.

For more information on protecting water sources, see ontario.ca/crops:

- OMAFRA Factsheet *Pesticide Contamination of Farm Water Supplies — Recommendations on Avoidance, Cleanup and Responsibilities*
- OMAFRA Factsheet *Groundwater — An Important Rural Resource: Protecting the Quality of Groundwater Supplies*
- OMAFRA Agriculture and Agri-Food Canada booklet *Best Management Practices — Pesticide Storage, Handling and Application*, Order No. BMP13

Bee Poisoning

Honeybees, native bee species and other pollinating insects are important pollinators for many Ontario crops. Insecticides, some of which may negatively affect bees, require careful management to achieve both pollination and insect control. Growers and licensed commercial applicators can protect bees by following these suggestions:

- Time insecticide applications to minimize bee exposure (e.g., apply post bloom). Daytime treatments, when bees are foraging, are most hazardous. Insecticide applications in the evening are the safest, unless there is evidence of a strong temperature inversion or high humidity. Under normal circumstances, spraying after 8 pm allows the spray to dry before the bees are exposed to it the next day. Spraying during early morning is the next best time, when fewer bees are foraging, but pesticide residues may still be present. Spraying should be completed well before 7 AM. While honeybees and most other pollinating insects do not usually forage at temperatures below 13°C, bumblebees do. If you plan to spray in the morning, contact beekeepers who have bees within 5 km of your crop and spray site. The beekeepers may then have the option of taking any possible protective action.
- Do not apply insecticides while fruit trees are in bloom. The *Bees Act* makes it an offence to do so in Ontario. Do not spray any flowering crop on which bees are foraging.
- To prevent drift toward nearby hives, do not apply insecticides on windy days or when there is evidence of a strong temperature inversion.
- Bees and other pollinators may be poisoned by visiting flowering weeds, trees and cover crops that have come into contact with an insecticide via spray drift or drift of insecticide-contaminated dust during planting. Avoid spray drift to flowering weeds that are adjacent to or within the target field. Where possible, mow down flowering cover

crops or flowering weeds in and bordering target fields prior to spraying to help safeguard the bees. Control dandelions and other flowering weeds within fields before spraying or planting seeds treated with an insecticide. Take measures to reduce movement of dust from insecticide seed treatments to flowering trees, weeds and water sources that are in or adjacent to the target field. For more information on reducing dust movement, see PMRA's *Pollinator Protection and Responsible Use of Treated Seed — Best Management Practices* at www.hc-sc.gc.ca/cps-spc/pubs/pest/_fact-fiche/pollinator-protection-pollinisateurs/treated_seed-semences_traitees-eng.php.
- Systemic insecticides may also pose a high risk to bees and other insect pollinators. Bees can be exposed to insecticide residues in or on flowers, leaves, pollen, nectar and/or surface water. Do not apply insecticide or allow it to drift onto blooming crops or off-site habitat if bees are foraging in or adjacent to the treatment area.
- Beekeepers should remove honeybee colonies as soon as pollination is complete in the crop and before any insecticides are applied post bloom. If the colonies cannot be removed in time, beekeepers can place burlap or cloth soaked in water at the entrance of the hive to disrupt the flight of the bees for up to 12 hr and provide more time for spray to dry. To help prevent overheating of the hive during this time, keep an opening of 2.5 cm on each side of the hive entrance so bees can still get out and ventilate the hive. Also, the water on the burlap or cloth will help cool the colony.
- If there is a risk of honeybee poisoning, try to choose an insecticide that is not highly toxic to bees. When there is a choice, choose a product formulation that is less hazardous to bees.
- Always read the most current label for guidance.
- Before applying a pesticide or planting with insecticide-treated seed, advise local beekeepers so they can move colonies out of the danger area, if this is an option.

Manage Drift

Pesticide drift is the aerial movement and unintentional deposit of pesticide outside the target area. Drift results in wasted product and may compromise crop protection and also may adversely affect nearby sensitive environmental areas, crops and wildlife. The following strategies can help reduce the risk of pesticide drift:

- Do not spray when wind speeds are high or gusty. These conditions increase the potential for spray and vapour drift. Check pesticide labels for allowable wind speeds for spraying applications. However, not all labels provide this specific information.
- Constantly monitor wind conditions during spraying using a good-quality wind meter. Record the wind speed and direction. As wind conditions change, you may need to make adjustments to further reduce the drift potential, such as increasing water volume, minimizing nozzle-to-target distance, changing nozzle technology, changing fields because of surrounding influences or stopping spraying until conditions improve.
- Do not spray during periods of dead calm. Periods of dead calm may occur in early morning or late evening, at which time the temperature is usually cooler and the relative humidity is typically higher, which can result in the spray droplets remaining aloft, like fog. When the wind picks up, these spray droplets can move away from the target area, possibly causing injury to adjacent non-target areas. Off-target drift in calm conditions can occur hours after the spray event was completed.

Temperature inversions create problems for spray applicators because pesticide spray can:

- stay concentrated for long periods over the target
- move with the cool air over considerable distances when the breeze picks up
- move down slopes and concentrate in low-lying regions
- drift unpredictably as the inversion dissipates during the morning

Field air temperatures are often very different from local or regional forecasts, so the most reliable method of detecting inversion conditions is to measure temperatures at, and several metres above, the ground. Spray applicators can recognize a temperature inversion when:

- there is a big difference between the daytime and nighttime temperatures
- early evening and nighttime wind speeds are considerably less than during the day
- sounds seem to carry farther
- odours seem more intense
- daytime cumulus clouds collapse toward evening
- overnight cloud cover is 25% or less
- mist, fog, dew or frost occur
- smoke or dust hangs in the air and/or moves laterally in a sheet

Temperature inversions start to form 3 hr prior to sunset, become stronger as the sun sets and continue until sunrise when the surface warms and air mixing begins. **If you suspect there's an inversion, don't spray. Often, warnings for the risk of inversions are stated right on the product label.**

- Use the sprayer output specified on the pesticide label.
- Use a nozzle that will produce the droplet size specified on the pesticide label or delivers droplets appropriate for the job. Nozzles that produce fine droplets are rarely, if ever, required.
- Where practical, use air induction nozzles, which significantly reduce drift compared to conventional nozzles.
- Check the height of the boom to the target or distance from airblast boom to the target.

Minimize the distance as much as possible while still maintaining spray uniformity.

- Establish buffer zones for the protection of adjacent sensitive areas. Some pesticide labels will state buffer zone setbacks; follow these carefully.
- Use spray plume protection where practical or available (hoods, shrouds, screens or air curtains).
- Use drift-reducing adjuvants in the spray tank as directed on the label. Mechanical or hydraulic agitations have been shown to reduce the effectiveness of certain drift-reducing adjuvants. Be aware that certain combinations of anti-drift adjuvants and air-induction nozzles have been shown to increase the incidence of fine droplets that will drift.
- When possible, use non-volatile pesticide formulations or products.

For more information about spray drift, see:

- Sprayers 101 - www.sprayers101.ca
- OMAFRA website: ontario.ca/spraydrift
- OMAFRA Factsheet *Pesticide Drift from Ground Applications*
- OMAFRA Agriculture and Agri-Food Canada booklet *Best Management Practices — Pesticide Storage, Handling and Application*, Order No. BMP13
- Ontario Pesticide Education Program (University of Guelph, Ridgetown Campus) videos *How to Manage Spray Drift* and *Spray Drift Reduction Through Air Induction*, available at www.opep.ca/index.cfm/learning- resources/videos/chapter-18-drift-of-pesticides/

Waste Management (container disposal)

Empty Pesticide Containers Up to 23 L

Never re-use empty containers.

The Ontario Empty Pesticide Container Recycling Program, an industry-led program, is available free of charge to growers and commercial applicators. Through this program, you can return triple-rinsed or pressure-rinsed plastic pesticide and fertilizer containers up to 23 L to container collection depots located throughout the province. Remove the cap and booklet from the pesticide container before recycling. To locate the closest container collection depot, visit www.cleanfarms.ca, call your local dealer, or contact CleanFARMS at 416-622- 4460 (toll-free at 877-622-4460) or info@cleanfarms.ca.

Empty Pesticide Containers Greater Than 23 L

Growers and commercial applicators should return pesticide containers that are greater than 23 L in size to the point of sale or to the manufacturer for disposal. Contact your local dealer for details on disposal of these containers, or contact CleanFARMS at 416-622-4460 (toll-free at 877-622-4460) or info@cleanfarms.ca.

Empty Seed and Pesticide Bags

Growers can return their empty seed and pesticide bags to select retail locations. Contact your local dealer for details on disposal of these empty seed and pesticide bags, or contact CleanFARMS at 416-622-4460 (toll-free at 877-622-4460) or info@cleanfarms.ca.

Surplus Spray Mix

The best approach is to plan the spray job accurately to avoid creating a surplus.

When this is unavoidable, dispose of excess spray mix by spraying it on other crops that require an application of this pesticide. Before spraying, check the label to make sure the pesticide is registered for use on that other crop.

If you cannot find another allowable crop to spray, then dilute the remaining spray mix by adding 10 parts of water for each 1 part of spray mix. The diluted solution can be safely applied to the original treated area as long as you do not exceed the pesticide rate recommended on the label. Be sure to check the label for any restrictions about crop rotation, days to harvest or disposal of surplus spray mix.

Never re-spray the treated field with undiluted spray mix. Spraying an area twice at the same pesticide rate will double the labeled pesticide rate. This may cause illegal pesticide residues in the harvested crop or harmful residues in the soil that can cause crop damage.

Surplus Pesticide Disposal

Be sure to safely dispose of pesticides that you do not need or cannot use. Options for proper disposal include:

- Contact the supplier. It is sometimes possible to return unused pesticide if it is still in its original, unopened container.
- Hire a waste hauler who is licensed under Part V of the *Environmental Protection Act* to carry hazardous wastes. Look in the Yellow Pages of your telephone directory under Liquid Waste Removal.
- CleanFARMS operates a free Obsolete Pesticide Collection Program throughout the province every three years. To locate the closest collection point and date, visit the CleanFARMS website (www.cleanfarms.ca), contact CleanFARMS at 416-622-4460 (toll free at 877-622-4460) or info@cleanfarms.ca or contact your local dealer for program details.
- Contact your municipality to see if any waste collection days are scheduled and verify whether quantities of agricultural pesticides will be accepted.

Storing Pesticides

Ontario's *Pesticides Act* and Regulation 63/09 provide details on storage requirements for pesticide storage facilities. As shown in Table 3–1, the storage requirements that must be followed are dependent on which classes of pesticides you store.

TABLE 3–1. Requirements for Pesticide Storage Facilities

	Pesticide Classes			
Storage requirements	**Class 2**	**Class 3**	**Class 4, 5 & 7**	**Class 6**
No contact with food or drink	**YES**	**YES**	**YES**	**YES**
Not an impairment to health and safety	**YES**	**YES**	**YES**	NO
Clean and orderly	**YES**	**YES**	**YES**	NO
Warning sign G posted*	**YES**	**YES**	**YES**	NO
Emergency telephone numbers posted**	**YES**	**YES**	**YES**	NO
Vented to outside	**YES**	**YES**	NO	NO
Limited access (locked)	**YES**	**YES**	NO	NO
No floor drain	**YES**	**YES**	NO	NO
Respiratory protection and protective clothing kept readily available	**YES**	**YES**	NO	NO
Area used primarily for pesticides	**YES**	NO	NO	NO

Note: Sufficient precautions are needed in your storage area to prevent the pesticide from entering the natural environment. Ensure your floor drain does not enter the natural environment.

* See ontario.ca for requirements for warning sign G (Search for sample warning signs for pesticide use). These signs can be purchased from your pesticide dealer/vendor.

** Emergency contact numbers must include telephone numbers for the local fire department, hospital and poison control centre. The number for the MOECC Spills Action Centre (1-800-268-6060) should also be readily available.

For more information about storing pesticides, see:

- OMAFRA Factsheet *Farm Pesticide Storage Facility*
- OMAFRA Agriculture and Agri-Food Canada booklet *Best Management Practices — Pesticide Storage, Handling and Application*, Order No. BMP13
- Ontario Pesticide Education Program (University of Guelph, Ridgetown Campus) *Grower Pesticide Safety Course Manual*, available at www.opep.ca. Select "Learning."

Pesticide Spills

If a pesticide spill causes, or is likely to cause, an adverse effect that is greater than that which would result from the proper use of the pesticide, you must notify the Ministry of the Environment and Climate Change Spills Action Centre at 1-800-268-6060 (24 hr a day, 7 days a week) and your municipality.

A spill is defined as a discharge of pollutant that is abnormal in quality or quantity, from or out of a structure, vehicle or other container into the environment. An incident such as an overturned pesticide sprayer that results in the loss of the spray solution to the environment is an example of a spill. A pesticide container that ruptures and leaks its contents is another example of a spill. The discharge or spraying of a pesticide in an unapproved area is also considered a spill.

Before you begin to clean up a spill of any nature, remember to protect yourself against pesticide exposure. Wear the proper protective clothing and personal protective equipment. If the spill occurs inside an enclosed area (e.g., a pesticide storage area or a vehicle during transport), ventilate the area first.

Once you have protected yourself and removed other persons or animals from the spill site, take additional measures to stop the spill at the source and prevent it from spreading and/or contaminating watercourses. Specific precautions, emergency contact information and first aid procedures may be found on the label.

For minor spills, it may be possible to rectify the problem:

- **For a liquid spill** — Cover the spill with a thick layer of absorbent material such as kitty litter, vermiculite or dry soil. Sweep or shovel the material into a waste drum and dispose of the contents as you would a hazardous waste.
- **For a dust, granular or powder spill** — Sweep or shovel the material into a waste drum and dispose of the contents as you would a hazardous waste.

For major spills, it is essential to stop the spill from spreading.

The cleanup guidelines above may not be appropriate for all spill situations. Once you have contained the spill, follow directions from the manufacturer and regulatory authorities on cleaning the contaminated area.

Some of the information contained in this chapter is not authoritative. It is derived from the *Pesticides Act*, Ontario Regulation 63/09 and the federal *Pest Control Products Act, Fisheries Act* and *Species at Risk Act* and is for informational purposes only. Efforts have been made to make it as accurate as possible, but in the event of a conflict, inconsistency or error, the requirements set out in the referenced legislation take precedence. For specific legal details, please visit ontario.ca/laws (for Ontario legislation) and www.laws.justice.gc.ca (for federal legislation) and consult your lawyer if you have questions about your legal obligations.

For information on preventing spills, see:

- OMAFRA Factsheet *Ways to Avoid Pesticide Spills*
- OMAFRA Agriculture and Agri-Food Canada booklet *Best Management Practices — Pesticide Storage, Handling and Application*, Order No. BMP13
- Ontario Pesticide Education Program (University of Guelph, Ridgetown Campus) *Grower Pesticide Safety Course Manual*, available at www.opep.ca. Select "Learning."

For pesticide poisonings and pesticide injuries, call:

Poison Information Centre: 1-800-268-9017

(TTY) 1-877-750-2233

For more information, see Emergency and First Aid Procedures for Pesticide Poisoning on inside back cover.

4. HERBICIDES USED IN ONTARIO

Herbicide Trade Names are listed alphabetically with the active ingredient in parenthesis. Refer to the active ingredient name in Table 4–1. *Herbicides Used in Ontario*, page 30, and the *Notes on Herbicides*, page 40, proceeding Table 4–1 for more information about a specific Trade Name:

1 2,4-D AMINE 600 (2,4-D)
2 2,4-D ESTER 700 (2,4-D)
3 AATREX LIQUID (atrazine)
4 ACCENT (nicosulfuron)
5 ACCENT TOTAL (nicosulfron + dica...)
6 ACCLAIM SUPER (fenoxaprop)
7 ACHIEVE LIQUID (tralkoxydim)
8 AIM EC (carfentrazone)
9 ALION 200 SC (indaziflam)
10 AMITROL 240 (amitrole)
11 ARMEZON (topramezone)
12 ARROW (clethodim)
13 ARSENAL (imazapyr)
14 ASSURE II (quizalofop-p-ethyl)
15 AUTHORITY 480 (sulfentrazone)
16 AXIAL BIA (pinoxaden)
17 BADGE (bromoxynil/MCPA)
18 BANVEL II (dicamba)
19 BASAGRAN (bentazon)
20 BASAGRAN FORTE (bentazon)
21 BASAMID (dazomet)
22 BATTALION (rimsulfuron + s-metolachlor + dicamba)
23 BENGAL (fenoxaprop-p-ethyl/safener)
24 BETAMIX B (desmediphan/phenmedipham)
25 BETASAN (bensulide)
26 BISON 400 L (tralkoxydim)
27 BLACKHAWK (carfentrazone + 2,4-D)
28 BLAZER (acifluorfen)
29 BOOST M (thifensulfuron-methyl/tribenuron + MCPA)
30 BONANZA 480 (trifluralin)
31 BOUNDARY LQD (s-metolachlor/metribuzin)
32 BROADSTAR (flumioxazin)
33 BROADSTRIKE RC (flumetsulam)
34 BROMAX (bromoxynil)
35 BROMOTRIL (bromoxynil)
36 BROTEX 240 (bromoxynil)
37 BROTEX 480 (bromoxynil)
38 BUCTRIL M (bromoxynil/MCPA)
39 CALIBER 625 (2,4-DB)
40 CALLISTO (mesotrione)
41 CALLISTO GT (mesotrione/glyphosate)
42 CASORON 4G (dichlobenil)
43 CANOPY PRO (chlorimuron + metribuzin)
44 CATENA (glyphosate)
45 CHAPERONE (chlorimuron-ethyl)
46 CHÂTEAU (flumioxazin)
47 CLASSIC (chlorimuron-ethyl)
48 CLEANSWEEP (imazethapyr + bentazon)
49 CLEARVIEW (aminopyralid/metsulfuron-methyl)
50 CLOVITOX PLUS (MCPA/MCPB)
51 COBUTOX 625 (2,4-DB)
52 COMMAND 360 ME (clomazone)
53 COMPITOX (mecoprop-P)
54 CONQUEST LQ (imazethapyr + metribuzin)
55 CONVERGE 480 (atrazine)
56 CONVERGE FLEXX (isoxaflutole)
57 CONVERGE XT (isoxaflutole + atrazine)
58 CREDIT XTREME (glyphosate)
59 DACTHAL W-75 (chlorthal dimethyl)
60 DESORMONE (dichlorprop/2,4-D)
61 DESORMONE XT (dichlorprop/2,4-D)
62 DESTRA (nicosulfuron/rimsulfuron + mesotrione)
63 DEVRINOL 10G (napropamide)
64 DEVRINOL 2G (napropamide)
65 DEVRINOL DF-XT (napropamide)
66 DEVRINOL DF (napropamide)
67 DICHORPROP DX (dichlorprop/2,4-D)
68 DIMENSION (dithiopyr)
69 DIQUASH (diquat)
70 DISTINCT (dicamba/diflufenzopyr)
71 DIUREX 80WDG (diuron)
72 DUAL II MAGNUM (s-metolachlor/benoxacor)
73 DYVEL (dicamba/MCPA)
74 ECOCLEAR (acetic acid)
75 ELIM SG (rimsulfuron)
76 EMBUTOX (2,4-DB)
77 ENGARDE (rimsulfuron + mesotrione)
78 ENLIST DUO (2,4-D choline salt/glyphosate)
79 EPTAM (EPTC)
80 ERAGON (saflufenacil)
81 ERAGON LQ (saflufenacil)
82 ESCORT (metsulfuron methyl)
83 ESTAPROP PLUS (dichlorprop/2,4-D)
84 ESTAPROP XT (dichlorprop/2,4-D)
85 EXCEL SUPER (fenoxaprop-p-ethyl)
86 EZJECT (glyphosate)
87 FACTOR 540 (glyphosate)
88 FIERCE (flumioxazin/pyroxasulfone)
89 FIESTA LAWN WEED KILLER (FeHEDTA)
90 FIRSTRATE (cloransulam-methyl)
91 FLEXSTAR GT (fomesafen/glyphosate)
92 FORTRAN 540 (glyphosate)
93 FORZA SILVICULTURE (glyphosate)
94 FOCUS (carfentrazone + pyroxasulfone)
95 FREESTYLE (chlorimuron + imazethapyr)
96 FRONTIER MAX (dimethenamid-P)
97 GALAXY 2 (nicosulfuron/rimsulfuron + glyphosate)
98 GALLERY (isoxaben)
99 GARLON 4 (triclopyr)
100 GARLON ULTRA (triclopyr)
101 GARLON XRT (triclopyr)
102 GARLON RTU (triclopyr)
103 GESAGARD 480 SC (prometryne)
104 GLYFOS (glyphosate)
105 GOAL 2XL (oxyfluorfen)
106 GRAMAXONE (paraquat)

107 GUARDIAN (chlorimuron + glyphosate)
108 GUARDIAN PLUS II (chlorimuron/flumioxazin + glyphosate)
109 HALEX GT (glyphosate/mesortione...)
110 HAWKEYE TM POWER (dicamba)
111 HYVAR X-L (bromacil)
112 IPCO PREMIUM 2-WAY XP TURF (mecoprop-P/2,4-D)
113 IPCO PREMIUM 3-WAY (2,4-D/mecoprop/dicamba)
114 IGNITE (glufosinate ammonium)
115 INFINITY (pyrasulfotole/bromoxynil)
116 INTEGRITY (saflufenacil/dimethenamid-P)
117 IMPACT (topramezone)
118 KARMEX (diruon)
119 KERB (propyzamide)
120 KILLEX 500 (2,4-D/mecoprop/dicamba)
121 KONA (citric + lactic acid)
122 KORIL (bromoxynil)
123 KROVAR (bromacil/diruon)
124 LEXONE 75 DF (metribuzin)
125 LIBERTY 200 SN (glufosinate)
126 LOGIC M (bromoxynil/MCPA)
127 LONTREL 360 (clopyralid)
128 LOROX DF (linuron)
129 LOROX L (linuron)
130 LUMAX EZ (s-metolachlor/benoxacor/atrazine/mesotrione)
131 MAGNACIDE H (acrolein)
132 MATRIX (glyphosate)
133 MARKSMAN (dicamba/atrazine)
134 MAVERICK III (glyphosate)
135 MCPA AMINE 500 (MCPA)
136 MCPA AMINE 600 (MCPA)
137 MCPA ESTER 500 (MCPA)
138 MCPA ESTER 600 (MCPA)
139 MCPA SODIUM 300 (MCPA)
140 MECOPROP (mecoprop-P)
141 MEXTROL (bromoxynil/MCPA)
142 MILESTONE (aminopyralid)
143 MUNGER HORT. VINEGAR (acetic acid)
144 MUSTER (ethametfulfuron-methyl)
145 NAVIUS (metsulfuron-methyl/aminocyclopyrachlor)
146 NORTRON SC (ethofumesate)
147 NU-IMAGE (imazethapyr)
148 OPTILL (saflufenacil/imazethapyr)
149 OPTION 2.25 OD (foramsulfuron)
150 ORACLE (dicamba)
151 OUTLOOK (dimethenamid-p)
152 PAR III (2,4-D/mecoprop/dicamba)
153 PARDNER (bromoxynil)
154 PAYLOAD (flumioxazin)
155 PEAK 75WG (prosulfuron)
156 PEAKPLUS (prosulfuron + dicamba)
157 PERFECTA (flumioxazin + metribuzin)
158 PERMIT (halosulfuron)
159 PHANTOM (imazethapyr)
160 PINNACLE SG (thifensulfuron-methyl)
161 PIXXARO A (halauxifen/fluroxypyr)
162 —
163 POAST ULTRA (sethoxydim)
164 POLARIS (glyphosate)
165 POLYDEX ALGAECIDE (copper)
166 POLYDEX ALGAECIDE MC (copper)
167 POLY PRO ALGAECIDE (copper)
168 POLYPRO ALGEACIDE (copper)
169 POND WIZARD ALGAECIDE (copper)
170 PREFAR (bensulide)
171 PREMIUM 3-WAY (2,4-D/mecoprop/dicamba)
172 PRIMEXTRA II MAGNUM (s-metolachlor/benoaxcor/atrazine)
173 PRINCEP NINE-T (simazine)
174 PRISM (rimsulfuron)
175 PRISM SG (rimsulfuron)
176 PRONONE (hexazinone)
177 PROWL 400 (pendimethalin)
178 PROWL H2O (pendimethalin)
179 PUMA ADVANCE (fenoxaprop-p-ethyl/safener)
180 PURSUIT (imazethapyr)
181 PYRAMIN FL (pyrazon)
182 REFINE M (thifensulfuron-methyl/tribenuron + MCPA)
183 REFINE SG (thifensulfuron-methyl/tribenuron)
184 REFLEX (fomesafen)
185 REGLONE DESSICANT (diquat)
186 REWARD AQUATIC (diquat aquatic)
187 RIVAL (trifluralin)
188 RIVET (glyphosate)
189 RONSTAR (oxadiazon)
190 ROUNDUP TRANSORB HC (glyphosate)
191 ROUNDUP ULTRA 2 (glyphosate)
192 ROUNDUP WEATHERMAX (glyphosate)
193 SANDEA (halosulfuron)
194 SARRITOR (sclerotinia minor)
195 SELECT (clethodim)
196 SENCOR 480 F (metribuzin)
197 SENCOR 75 DF (metribuzin)
198 SHARPSHOOTER (glyphosate)
199 SHARPSHOOTER PLUS (glyphosate)
200 SIMADEX (simazine)
201 SIMAZINE 480 (simazine)
202 SINBAR (terbacil)
203 SINBAR WDG (terbacil)
204 STEP-UP (chlorimuron-ethyl + flumioxazin)
205 SUREGUARD (flumioxazin)
206 SWORD (dicamba/MCPA/mecoprop-P)
207 TARGET (dicamba/MCPA/mecoprop-P)
208 TELAR (chlorsulfuron)
209 THINK PURITY ALGAECIDE (copper)
210 THINK PURITY ALGAECIDE & ODOUR CONTROL (copper)
211 TOUCHDOWN TOTAL (glyphosate)
212 TOPSIDE (MCPB/MCPA)
213 TORDON 101 (picloram/2,4-D)
214 TRACKER XP (dicamba/MCPA/mecoprop-P)
215 TRAXION (glyphosate)
216 TRIACTOR (flumioxazin + metribuzin + imazethapyr)
217 TRIANGLE BRAND COPPER SULPHATE CRYSTAL (copper)
218 TRI-KIL (2,4-D/mecoprop/dicamba)
219 TRILLION-P (2,4-D/mecoprop/dicamba)
220 TREFLAN (trifulrualin)
221 TROPHY A (fluroxypyr)
222 TROPHY B (MCPA)
223 TROPOTOX PLUS (MCPB/MCPA)
224 TRUVIST (chlorsulfuron/aminocyclopyrachlor)
225 TURBOPROP (dichlorprop/2,4-D)
226 TURFMAIZE (corn gluten meal)
227 TURFRITE 2+2 (mecoprop-P/2,4-D)
228 ULTIM 75 DF (nicosulfuron/rimsulfuron)
229 ULTIM TOTAL (nicosulfuron/rimsulfuron + diflufenzopyr/dicamba)
230 UPBEET (triflusulfuron-methyl)
231 VALTERA (flumioxazin)
232 VANTAGE PLUS MAX II (glyphosate)
233 VANTAGE XRT (glyphosate)

234 VANQUISH (dicamba)
235 VAPAM (metam sodium)
236 VELPAR (hexazinone)
237 VENTURE L (fluazifop-p-butyl)
238 VIGIL (fenoxaprop-p-ethyl/safener)
239 VIOS G3 (tembotrione/thiencarbazone-methyl)
240 VMD 480 (dicamba)
241 WEEDAWAY 3-WAY (2,4-D/mecoprop/dicamba)
242 XTENDIMAX (dicamba)
243 YUMA GL (quizalofop-p-ethyl)

TABLE 4–1. Herbicides Used in Ontario

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SG = soluble granules
WP = wettable powder
EC = emulsifiable concentrate
ME = microencapsulated suspension
Sn = solution
– = not specified on label
EM = emulsion
OD = oil dispersible
SP = soluble powder

Active Ingredient	TRADE NAME	Formulation	Concentration[1]	WSSA[2] Groups	PCP Number[3]	Class.[4]	Manufacturer Agent Code[5]
2,4-D	2,4-D AMINE 600	Sn	564 g/L	4	5931	4	UAG
2,4-D	2,4-D AMINE 600, IPCO	Sn	564 g/L	4	17511	4	INT
2,4-D	2,4-D AMINE 600, NUFARM	Sn	564 g/L	4	14726	4	NUA
2,4-D	2,4-D ESTER 700, IPCO	EC	660 g/L	4	27819	3	INT
2,4-D	2,4-D ESTER 700, NUFARM	EC	660 g/L	4	27820	3	NUA
2,4-D	2,4-D ESTER 700, SALVO	EC	660 g/L	4	27820	3	UAG
2,4-D choline salt/glyphosate	ENLIST DUO	Sn	398 g/L	4, 9	30958	3	DWE
2,4-DB	CALIBER 625	EC	625 g/L	4	27910	3	UAG
2,4-DB	COBUTOX 625	EC	625 g/L	4	28346	3	INT
2,4-DB	EMBUTOX	EC	625 g/L	4	19217	3	NUA
2,4-D/dicamba/mecoprop-P	IPCO PREMIUM 3-WAY XP TURF HERBICIDE	Sn	308 g/L	4	27846	4	INT
2,4-D/dicamba/mecoprop-P	KILLEX 500	Sn	308 g/L	3	27975	4	SGF
2,4-D/dicamba/mecoprop-P	PAR III	Sn	308 g/L	4	27884	4	UAG
2,4-D/dicamba/mecoprop-P	TRI-KIL	Sn	308 g/L	4	27970	4	AGR
2,4-D/dicamba/mecoprop-P	TRILLION-P LIQUID TURF HERBICIDE	Sn	308 g/L	4	27972	4	PLG
2,4-D/dicamba/mecoprop-P	WEEDAWAY PREMIUM 3-WAY XP TURF HERBICIDE	Sn	308 g/L	4	27848	4	INT
acetic acid	ECOCLEAR	Sn	25%	–	25528	4	TIU
acetic acid	MUNGER HORTICULTURE VINEGAR PLUS	Sn	20%	–	29405	4	MUF
acifluorfen	BLAZER	Sn	240 g/L	14	23315	3	UPI
acrolein	MAGNACIDE	Sn	95%	–	10948	2	BAK
aminopyralid	MILESTONE	Sn	240 g/L	4	28517	3	DWE
aminopyralid/metsulfuron-methyl	CLEARVIEW	WG	52.5 + 9.45%	4, 2	29752	3	DWE
amitrole	AMITROL 240	Li	231 g/L	11	25684	3	NUA
atrazine	CONVERGE 480	Su	480 g/L	5	26227	3	BCZ
bensulide	BETASAN	EC	480 g/L	8	9057	4	GOW

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[3] The product registration number for this trade name under the *Pesticide Control Product Act*, commonly referred to as a "PCP number". The PCP number has been placed in the guide for convenience, but the pesticide label in possession should always be used for the most accurate and current PCP number.

[4] Refers to the numeric classification of pesticides under Regulation 63/09 of the Pesticides Act. Refer to Table 4–2. *Description for Ontario Classification of Pesticide Products*, on page 40, for a description of each Ontario classification.

[5] Refers to the registrant of the herbicide. See Appendix G. *Herbicide Companies and Agents*, page 455. Phone numbers and websites are also listed.

[6] Indicates herbicides sold as a co-pack under this trade name.

TABLE 4–1. Herbicides Used in Ontario (cont'd)

Mention of a brand or trade name in this table does not constitute a guarantee or warranty of the product. Always refer to the product label before using.

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DG = dry granules
Gr = granular
SC = soluble concentrate
WG = wettable granules
DS = dry soluble
Li = liquid
SG = soluble granules
WP = wettable powder
EC = emulsifiable concentrate
ME = microencapsulated suspension
Sn = solution
– = not specified on label
EM = emulsion
OD = oil dispersible
SP = soluble powder

Active Ingredient	TRADE NAME	Formulation	Concentration[1]	WSSA[2] Groups	PCP Number[3]	Class.[4]	Manufacturer Agent Code[5]
bensulide	PREFAR	EM + Li	480 g/L	8	14113	4	GOW
bentazon	BASAGRAN	Li	480 g/L	6	12221	4	BAZ
bentazon	BASAGRAN FORTÉ	Li	480 g/L	6	22006	4	BAZ
bentazon/atrazine	LADDOK	Li Su	(1:1) 400 g/L	5,6	16641	3	BAZ
bromacil	HYVAR X-L	Sn	240 g/L	5	11018	3	BCZ
bromacil/diuron	KROVAR	DF	(1:1) 80%	5,7	22964	3	BCZ
bromoxynil	BROMAX	Li	480 g/L	6	31431	3	INT
bromoxynil	BROMOTRIL	EC	240 g/L	6	28276	3	MKC
bromoxynil	BROTEX 240	Li	240 g/L	6	28519	3	INT
bromoxynil	BROTEX 480	Li	480 g/L	6	31348	3	INT
bromoxynil	KORIL	EC	235 g/L	6	25341	3	NUA
bromoxynil	PARDNER	EC	280 g/L	6	18001	3	BCZ
bromoxynil/MCPA	BADGE	EC	(1:1) 450 g/L	4,6	16164	3	UAG
bromoxynil/MCPA	BUCTRIL M	EC	(1:1) 560 g/L	4,6	18022	3	BCZ
bromoxynil/MCPA	LOGIC M	EC	(1:1) 450 g/L	4,6	28109	3	INT
bromoxynil/MCPA	MEXTROL	EC	(1:1) 450 g/L	4,6	26999	3	NUA
carfentrazone-ethyl	AIM EC	EC	240 g/L	14	28573	3	NUA
carfentrazone-ethyl + 2,4-D	BLACKHAWK (AIM + 2,4-D)	EC + EC	240 + 660 g/L	4, 14	28573 + 27820	3, 4	NUA
chlorimuron-ethyl	CLASSIC	WG	25%	2	25433	3	DUQ
chlorimuron-ethyl	CHAPERONE	WG	25%	2	30475	3	NUA
chlorimuron-ethyl + glyphosate	GUARDIAN[6] (CLASSIC + POLARIS)	DF + Sn	25% + 360 g/L	2,9	25433 + 29479	3, 4	DUQ
chlorimuron-ethyl + flumioxazin + glyphosate	GUARDIAN PLUS II (GUARDIAN PLUS WDG + POLARIS)	WG + WDG + Sn	5.14% + 40.59% + 360 g/L	2,14,9	31494 + 29479	3, 4	DUQ
chlorimuron-ethyl + flumioxazin	STEP-UP	DF + WDG	25% + 51.1%	2, 14	30475 + 29230	3, 4	NUA
chlorimuron-ethyl + metribuzin	CANOPY PRO	WG + DF	25% + 75%	2, 5	29416 + 30661	3, 4	DUQ

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TABLE 4–1. Herbicides Used in Ontario (cont'd)

Mention of a brand or trade name in this table does not constitute a guarantee or warranty of the product. Always refer to the product label before using.

DC = dispersible concentrate
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DG = dry granules
DS = dry soluble
EC = emulsifiable concentrate
EM = emulsion
F = flowable
Gi = gel
Gr = granular
Li = liquid
ME = microencapsulated suspension
OD = oil dispersible
PE = pellets
PS = pressurized spray
SC = soluble concentrate
SG = soluble granules
Sn = solution
SP = soluble powder
Su = suspension (flowable)
WDG = wettable dry granules
WG = wettable granules
WP = wettable powder
– = not specified on label

Active Ingredient	**TRADE NAME**	**Formulation**	**Concentration**[1]	**WSSA**[2] **Groups**	**PCP Number**[3]	**Class.**[4]	**Manufacturer Agent Code**[5]
chlorsulfuron	TELAR	DF	75%	2	21533	3	BCZ
chlorthal dimethyl	DACTHAL W-75	DF	75%	3	8963	4	UAG
citric acid + lactic acid	KONA	Su	19.71 + 17.69 g/L	–	29603	4	LPH
clethodim	ARROW	EC	240 g/L	1	28224	3	MKC
clethodim	SELECT	EC	240 g/L	1	22625	3	AVV
clomazone	COMMAND 360 ME	ME	360 g/L	13	27827	3	UAG
clopyralid	LONTREL 360	Sn	360 g/L	4	23545	3	DWE
cloransulam-methyl	FIRSTRATE	WG	84%	2	26697	3	DWE
copper	POLYDEX ALGAECIDE	Sn	5%	–	23636	4	OCI
copper	POLYDEX ALGAECIDE MC	MC	5%	–	27770	4	OCI
copper	POLY PRO ALGAECIDE	Sn	5%	–	27769	4	OCI
copper	POND WIZARD ALGAECIDE	Sn	5%	–	28866	4	PDW
copper	THINK PURITY ALGAECIDE	Sn	5%	–	27754	4	GRQ
copper	THINK PURIT Y ALGAECIDE AND ODOUR CONTROL	Sn	5%	–	27434	4	GRQ
copper	TRIANGLE BRAND COPPER SULPHATE CRYSTAL	Gr	25.2%	–	24200	4	FMS
corn gluten meal	TURFMAIZE	Gr	98%	–	27865	4	ENF
dazomet	BASAMID	Gr	97%	27	15032	3	BAZ
desmedipham/phenmedipham	BETAMIX B	EC	(1:1) 153 g/L	5	28650	4	BCZ
dicamba	BANVEL II	Sn	480 g/L	4	23957	3	BAZ
dicamba	HAWKEYE™ POWER	Sn	480 g/L	4	29223	3	GHA
dicamba	ORACLE	Sn	480 g/L	4	26722	3	UAG
dicamba	VANQUISH	Sn	480 g/L	4	26980	3	SYN
dicamba	VMD 480	Sn	480 g/L	4	29251	3	GHA
dicamba	XtendiMax with VaporGrip Technology	Sn	350 g/L	4	31896	3	MOX
dicamba/atrazine	MARKSMAN	Su	393 g/L	4,5	19349	3	BAZ

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SG = soluble granules
WP = wettable powder
EC = emulsifiable concentrate
ME = microencapsulated suspension
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Active Ingredient	TRADE NAME	Formulation	Concentration[1]	WSSA[2] Groups	PCP Number[3]	Class.[4]	Manufacturer Agent Code[5]
dicamba/MCPA	DYVEL	Sn	(1:4) 420 g/L	4	16545	3	BAZ
dicamba/MCPA/mecoprop-P	SWORD	Sn	400 g/L	4	27892	4	UAG
dicamba/MCPA/mecoprop-P	TARGET	Sn	400 g/L	4	28028	4	SYN
dicamba/MCPA/mecoprop-P	TRACKER XP	Sn	400 g/L	4	27790	4	INT
dichlobenil	CASORON 4G	Gr	4%	20	12533	4	CRE
dichlorprop/2,4-D	DICHLORPROP DX	EC	610 g/L	4	29664	3	INT
dichlorprop/2,4-D	ESTAPROP PLUS	EC	(1:1) 582 g/L	3	27968	3	NUA
dichlorprop/2,4-D	ESTAPROP XT	EC	610 g/L	4	29660	3	NUA
dichlorprop/2,4-D	TURBOPROP	EC	582 g/L	4	27967	3	UAG
diflufenzopyr/dicamba	DISTINCT	WDG	70%	4,19	26406	3	BAZ
dimethenamid-P	FRONTIER MAX	EC	720 g/L	15	29194	3	BAZ
dimethenamid-P	OUTLOOK	EC	720 g/L	15	30947	3	BAZ
dithiopyr	DIMENSION	EC	124 g/L	3	23003	3	DWE
diuron	DIUREX 80WDG	WG	80%	7	26949	3	DKC
diuron	KARMEX	DF	80%	7	28543	3	AMA
diquat	DIQUASH DESICCANT	Sn	240 g/L	22	31406	3	SCL
diquat	REGLONE DESSICANT	Li	240 g/L	22	26396	4	SYN
diquat (aquatic)	REWARD AQUATIC	Li	240 g/L	22	26271	3	SYN
EPTC	EPTAM	EC	800 g/L	8	11284	5	GOW
ethametsulfuron-methyl	MUSTER	DF	75%	2	23569	3	DUQ
ethofumesate	NORTRON SC	Su	480 g/L	16	17293	3	BCZ
FeHEDTA	FIESTA LAWN WEED KILLER	Sn	4.43%	–	29535	4	NEF
fenoxaprop-p-ethyl	ACCLAIM SUPER	EC	80.5 g/L	1	22886	3	BCZ
fenoxaprop-p-ethyl	EXCEL SUPER	EC	80.5 g/L	1	22205	3	BCZ
fenoxaprop-p-ethyl/safener	BENGAL	EC	120 g/L	1	29268	3	MKC

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Active Ingredient	TRADE NAME	Formulation	Concentration[1]	WSSA[2] Groups	PCP Number[3]	Class.[4]	Manufacturer Agent Code[5]
fenoxaprop-p-ethyl/safener	VIGIL	EC	120 g/L	1	29273	3	INT
fenoxaprop-p-ethyl/safener	PUMA ADVANCE	EC	90 g/L	1	29615	3	BCZ
fluazifop-p-butyl	VENTURE L	EC	125 g/L	1	21209	2	SYN
flumetsulam	BROADSTRIKE RC	WG	80%	2	27004	3	DWE
flumioxazin	BROADSTAR	Gr	25%	14	29229	4	VAJ
flumioxazin	CHATEAU	WDG	51.1%	14	29231	4	VAJ
flumioxazin	PAYLOAD	WDG	51.1%	14	29232	4	VAJ
flumioxazin	SUREGUARD	WDG	51.1%	14	29236	4	VAJ
flumioxazin	VALTERA	WDG	51.1%	14	29230	4	VAJ
flumioxazin/metribuzin	PERFECTA[6] (VALTERA + TRICOR)	WDG + DF	51.1% + 75%	14,5	29230 + 30661	4	NUA
flumioxazin/metribuzin/imazethapyr	TRIACTOR[6] (VALTERA + TRICOR + NU-IMAGE)	WDG + DF + Sn	51.1% + 75% + 240 g/L	14,5,2	29230 + 30661 + 30420	4	NUA
flumioxazin/pyroxasulfone	FIERCE	WDG	76%	14,15	31117	4	VAJ
fluroxypyr	TROPHY A	EC	180 g/L	4	27246	3	NUA
fomesafen	REFLEX	Sn	240 g/L	14	24779	3	SYN
foramsulfuron	OPTION 2.25 OD	OD	22.5 g/L	2	27424	4	BCZ
fosamine ammonium	KRENITE	Sn	480 g/L	27	14064	4	DUQ
glyphosate	CREDIT XTREME	Sn	540 g/L	9	29888	3	NUA
glyphosate	EZJECT	P	0.15 g/capsule	9	21262	4	MOX
glyphosate	FACTOR 540	Sn	540 g/L	9	27988	4	INT
glyphosate	FORTRAN 540	Li	540 g/L	9	31199	4	INT
glyphosate	FORZA SILVICULTURAL HERBICIDE	Sn	360 g/L	9	26401	4	CAU
glyphosate	GLYFOS	SC	360 g/L	9	24359	4	CAU
glyphosate	MAVERICK III	Sn	480 g/L	9	28977	4	DOW
glyphosate	MATRIX	Sn	480 g/L	9	29775	4	INT

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[3] The product registration number for this trade name under the *Pesticide Control Product Act*, commonly referred to as a "PCP number". The PCP number has been placed in the guide for convenience, but the pesticide label in possession should always be used for the most accurate and current PCP number.

[4] Refers to the numeric classification of pesticides under Regulation 63/09 of the Pesticides Act. Refer to Table 4–2. *Description for Ontario Classification of Pesticide Products*, on page 40, for a description of each Ontario classification.

[5] Refers to the registrant of the herbicide. See Appendix G. *Herbicide Companies and Agents*, page 455. Phone numbers and websites are also listed.

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TABLE 4–1. Herbicides Used in Ontario (cont'd)

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Li = liquid
ME = microencapsulated suspension
OD = oil dispersible
PE = pellets
PS = pressurized spray
SC = soluble concentrate
SG = soluble granules
Sn = solution
SP = soluble powder
Su = suspension (flowable)
WDG = wettable dry granules
WG = wettable granules
WP = wettable powder
– = not specified on label

Active Ingredient	TRADE NAME	Formulation	Concentration[1]	WSSA[2] Groups	PCP Number[3]	Class.[4]	Manufacturer Agent Code[5]
glyphosate	POLARIS	Li	360 g/L	9	29479	4	DUQ
glyphosate	RIVET	Sn	480 g/L	9	31090	4	INT
glyphosate	ROUNDUP TRANSORB HC	Sn	540 g/L	9	28198	4	MOX
glyphosate	ROUNDUP ULTRA2	Li	540 g/L	9	27764	4	MOX
glyphosate	ROUNDUP WEATHERMAX	Sn	540 g/L	9	27487	4	MOX
glyphosate	SHARPSHOOTER	SC	356 g/L	9	28631	4	UAG
glyphosate	SHARPSHOOTER PLUS	Sn	360 g/L	9	28623	4	UAG
glyphosate	TOUCHDOWN TOTAL	Sn	500 g/L	9	28072	4	SYN
glyphosate	TRAXION	Sn	500 g/L	9	29201	4	SYN
glyphosate	VANTAGE PLUS MAX II	Sn	480 g/L	9	28840	4	DOW
glyphosate	VANTAGE XRT	Sn	480 g/L	9	29994	4	DOW
glyphosate	VISION MAX SILVICULTURE	Sn	540 g/L	9	27736	4	MOX
glyphosate/mesotrione/s-metolachlor/benoxacor	HALEX GT	Sn	525 g/L	9,27,15	29341	4	SYN
glufosinate ammonium	IGNITE	Sn	150 g/L	10	28532	4	BCZ
glufosinate ammonium	LIBERTY 200SN	Sn	200 g/L	10	25337	4	BCZ
glyphosate/fomesafen	FLEXSTAR GT	Sn	338 g/L	9,14	30412	3	SYN
halauxifen/fluroxypyr	PIXXARO A	EC	16.25 + 250 g/L	4	31303	3	DOW
halosulfuron	PERMIT	WG	72.6%	2	31210	3	GOW
halosulfuron	SANDEA	WG	72.6%	2	31209	3	GOW
hexazinone	PRONONE	Gr	10%	5	21390	4	DUQ
hexazinone	VELPAR	DF	90%	5	25225	3	DUQ
imazapyr	ARSENAL	Sn	240 g/L	2	23713	3	BAZ
imazethapyr	NU-IMAGE	Sn	240 g/L	2	30420	2	NUA
imazethapyr	PURSUIT	Sn	240 g/L	2	26287	2	BAZ

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Li = liquid
SG = soluble granules
WP = wettable powder
EC = emulsifiable concentrate
ME = microencapsulated suspension
Sn = solution
– = not specified on label
EM = emulsion
OD = oil dispersible
SP = soluble powder

Active Ingredient	**TRADE NAME**	**Formulation**	**Concentration[1]**	**WSSA[2] Groups**	**PCP Number[3]**	**Class.[4]**	**Manufacturer Agent Code[5]**
imazethapyr	PHANTOM	Sn	240 g/L	2	30017	2	MKC
imazethapyr + bentazon	CLEANSWEEP[6] (PURSUIT + BASAGRAN FORTÉ)	Sn + Sn	240 g/L + 480 g/L	2,6	26287 + 22006	3,4	BAZ
imazethapyr + metribuzin	CONQUEST LQ[6] (PURSUIT + SENCOR)	Sn + F	240 g/L + 480 g/L	2,5	26287 + 29346	3	BAZ
indaziflam	ALION 200 SC	SC	200 g/L	29	30221	pending	BCZ
isoxaben	GALLERY	DF	75%	21	24110	3	DWE
isoxaflutole	CONVERGE FLEXX	SC	240 g/L	27	29071	2	BCZ
isoxaflutole + atrazine	CONVERGE XT[6] (CONVERGE FLEXX + CONVERGE 480)	SC + SC	240 g/L + 480 g/L	5,27	29071 + 26277	2,3	BCZ
linuron	LOROX DF	DF	50%	7	20193	4	TES
linuron	LOROX L	LiSu	480 g/L	7	16279	4	TES
MCPA	MCPA AMINE 500	Sn	500 g/L	4	9516	4	UAG
MCPA	MCPA AMINE 500, IPCO	Sn	500 g/L	4	20308	4	INT
MCPA	MCPA AMINE 600, NUFARM	Sn	600 g/L	4	28384	3	NUA
MCPA	MCPA ESTER 600, IPCO	Sn	600 g/L	4	27802	3	INT
MCPA	MCPA ESTER 600, NUFARM	Sn	600 g/L	4	27803	3	NUA
MCPA	MCPA SODIUM 300	Sn	300 g/L	4	9858	4	UAG
MCPA	MCPA SODIUM 300, IPCO	Sn	300 g/L	4	20306	4	INT
MCPA	MCPA SODIUM 300, NUFARM	Sn	300 g/L	4	14718	4	NUA
MCPA	TROPHY B	Sn	500 g/L	4	27245	3	NUA
MCPB/MCPA	CLOVITOX PLUS	Li	375 g/L + 25 g/L	4	24336	4	INT
MCPB/MCPA	TOPSIDE	Li	400 g/L	4	22003	4	UAG
MCPB/MCPA	TROPOTOX PLUS	Li	400 g/L	4	8211	4	NUA
mecoprop-P	COMPITOX	Sn	150 g/L	4	27824	4	NUA
mecoprop-P	MECOPROP P	Sn	150 g/L	4	27891	4	UAG
mecoprop/2,4-D	TURF-RITE 2+2	Sn	(1:1) 400 g/L	4	27969	4	AGR

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[3] The product registration number for this trade name under the *Pesticide Control Product Act*, commonly referred to as a "PCP number". The PCP number has been placed in the guide for convenience, but the pesticide label in possession should always be used for the most accurate and current PCP number.

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Gr = granular
SC = soluble concentrate
WG = wettable granules
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Li = liquid
SG = soluble granules
WP = wettable powder
EC = emulsifiable concentrate
ME = microencapsulated suspension
Sn = solution
– = not specified on label
EM = emulsion
OD = oil dispersible
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Active Ingredient	TRADE NAME	Formulation	Concentration[1]	WSSA[2] Groups	PCP Number[3]	Class.[4]	Manufacturer Agent Code[5]
mecoprop-P/2,4-D	IPCO PREMIUM 2-WAY XP TURF HERBICIDE	Sn	(1:1) 400 g/L	4	27779	4	INT
mesotrione	CALLISTO	SC	480 g/L	27	27833	3	SYN
mesotrione/glyphosate	CALLISTO GT	Su	45.5 + 455	27/9	31711	3	SYN
metam sodium	VAPAM	Sn	380 g/L	27	29128	4	UAG
metribuzin	LEXONE 75 DF	WG	75%	5	21077	3	DUQ
metribuzin	SENCOR 480 F	F	480 g/L	5	27091	3	BCZ
metribuzin	SENCOR 75 DF	WG	75%	5	17242	3	BCZ
metsulfuron methyl	ESCORT	DF	60%	2	23005	3	BCZ
napropamide	DEVRINOL 10G	Gr	10%	15	25230	4	UAG
napropamide	DEVRINOL 2G	Gr	2%	15	25297	4	UAG
napropamide	DEVRINOL DF-XT	DF	50 DF	15	30081	4	UAG
napropamide	DEVRINOL DF	DF	50 DF	15	25231	4	UAG
nicosulfuron	ACCENT	DF	75%	2	25116	3	DUQ
nicosulfuron + diflufenzopyr/ dicamba	ACCENT TOTAL[6] (ACCENT + DISTINCT)	DF + WG	75% + 70%	2,4	25116 + 26406	3	DUQ
nicosulfuron/rimsulfuron	ULTIM 75DF	DF	(1:1) 75%	2	24736	3	DUQ
nicosulfuron/rimsulfuron + diflufenzopyr/dicamba	ULTIM TOTAL[6] (ULTIM + DISTINCT)	DF + WDG	75% + 70%	2,4	24736 + 26406	3	DUQ
nicosulfuron/rimsulfuron + mesotrione	DESTRA[6] (DESTRA 75DF + MESOTRIONE 480 SC)	DF + SC	75% + 480 g/L	2, 27,	31613 + 31163	3	DUQ
nicosulfuron/imsulfuron + glyphosate	GALAXY 2[6] (ULTIM + POLARIS)	DF + Sn	25% + 540 g/L	2,9	24736 + 29479	3,4	DUQ
oxadiazon	RONSTAR 2G	Gr	2%	14	23600	3	BCZ
oxyfluorfen	GOAL 2XL	EC	240 g/L	14	24913	2	DWE
paraquat	GRAMOXONE	Sn	200 g/L	22	8661	3	SYN
pendimethalin	PROWL 400	EC	400 g/L	3	23439	2	BAZ

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Active Ingredient	**TRADE NAME**	**Formulation**	**Concentration**[1]	**WSSA**[2] **Groups**	**PCP Number**[3]	**Class.**[4]	**Manufacturer Agent Code**[5]
pendimethalin	PROWL H2O	ME	455 g/L	3	29542	2	BAZ
picloram/2,4-D	TORDON 101	Sn	(1:3.7) 305 g/L	4	9007	3	DWE
pinoxaden	AXIAL BIA	EC	50 g/L	1	30431	4	SYN
prometryne	GESAGARD 480 SC	Su	480 g/L	5	24771	3	SYN
propyzamide	KERB	WP	50%	15	25595	3	DWE
prosulfuron	PEAK 75 WG	WG	75%	2	25310	3	SYN
pyrasulfotole/bromoxynil	INFINITY	EC	247.5 g/L	27,6	28738	3	BCZ
pyroxasulfone + carfentrazone-ethyl	FOCUS[6] (pyroxasulfone 85 + Aim EC)	WG + EC	85% + 240 g/L	15,14	30572 + 28573	3	FMC
pyrazon	PYRAMIN FL	Su	430 g/L	5	15857	4	BAZ
quizalofop-p-ethyl	ASSURE II	EC	96 g/L	1	25462	3	DUQ
quizalofop-p-ethyl	YUMA GL	EC	96 g/L	1	29134	3	GOW
rimsulfuron	ELIM SG	SG	25%	2	29641	3	DUQ
rimsulfuron	PRISM SG	SG	25%	2	30057	3	DUQ
rimsulfuron + s-metolachlor/benoxacor + dicamba	BATTALION[6] (ELIM + DUAL II MAGNUM + BANVEL II)	DF + EC + Sn	25% + 915 g/L + 480 g/L	2,15,4	23518 + 25729 + 23957	3	DUQ
rimsulfuron + mesotrione	ENGARDE[6] (ENGARD 25 SG + MESOTRIONE 480 SC)	DF + SC	25% + 480 g/L	2,27	31142 + 31163	3	DUQ
saflufenacil	ERAGON LQ	Su	342g/L	14	31469	3	BAZ
saflufenacil/dimethenamid-P	INTEGRITY	EC	68 g/L + 600 g/L	14,15	29371	3	BAZ
saflufenacil/imazethapyr	OPTILL	WDG	68%	14,2	30756	3	BAZ
s-metolachlor/metribuzin	BOUNDARY LQD	EC	628 g/L + 149 g/L	5,15	30812	3	SYN
s-metolachlor/benoxacor	DUAL II MAGNUM	EC	915 g/L	15	25729	3	SYN
s-metolachlor/benoxacor/atrazine	PRIMEXTRA II MAGNUM	SC	(1:0.8) 720 g/L	5,15	25730	3	SYN
s-metolachlor/benoxacor/atrazine/ mesotrione	LUMAX EZ	Su	298 g/L + 112 g/L + 29.8 g/L	5,15,27	30864	3	SYN
Sclerotinia minor strain IMI 344141	SARRITOR	Gr	300 CFU/g	–	28545	3	SAR

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Active Ingredient	TRADE NAME	Formulation	Concentration[1]	WSSA[2] Groups	PCP Number[3]	Class.[4]	Manufacturer Agent Code[5]
sethoxydim	POAST ULTRA	EC	450 g/L	1	24835	4	BAZ
simazine	PRINCEP NINE-T	WG	90%	5	16370	3	SYN
simazine	SIMADEX	Su	500 g/L	5	15902	3	BCZ
simazine	SIMAZINE 480	Su	480 g/L	5	23181	3	UAG
sulfentrazone	AUTHORITY 480	Su	480 g/L	14	29012	3	FMC
tembotrione/thiencarbazone-methyl	VIOS G3	Su	70 g/L + 350 g/L	2,27	29643	4	BCZ
terbacil	SINBAR	WP	80%	5	10628	3	TES
terbacil	SINBAR WDG	WDG	80%	5	30082	2	TES
thifensulfuron-methyl	PINNACLE SG	SG	50%	2	29349	4	DUQ
thifensulfuron-methyl/ tribenuron-methyl	REFINE SG	SG	50%	2	28286	3	DUQ
thifensulfuron-methyl/ tribenuron-methyl + MCPA	BOOST M[6] (BOOST + MCPA ESTER 600)	SG, EC	50% + 600 g/L	2,4	30377 + 27803	4,3	NUA
thifensulfuron-methyl/ tribenuron-methyl + MCPA	REFINE M[6] (REFINE SG + MCPA ESTER 600)	SG, EC	50% + 600 g/L	2,4	28286 + 27803	3	DUQ
topramezone	ARMEZON	SC	336 g/L	27	30131	3	BAZ
topramezone	IMPACT	SC	336 g/L	27	28141	3	UAG
tralkoxydim	ACHIEVE LIQUID	EC	400 g/L	1	27011	4	DOW
tralkoxydim	BISON 400 L	SC	400 g/L	1	29256	4	MKC
triclopyr	GARLON ULTRA	EC	480 g/L	4	28434	3	DWE
triclopyr	GARLON XRT	EC	755 g/L	4	28945	3	DWE
triclopyr	GARLON RTU	Sn	755 g/L	4	29334	3	DWE
trifluralin	BONANZA 480	Li	480 g/L	3	28289	4	UAG
trifluralin	RIVAL	EC	500 g/L	3	18612	4	NUA
trifluralin	TREFLAN EC	EC	480 g/L	3	23933	4	DWE
triflusulfuron-methyl	UPBEET	DF	50%	2	25813	3	DUQ

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TABLE 4–2. Description for Ontario Classification of Pesticide Products

Ontario Classification	Summary*
1	Designated under the *Pesticide Control Product Act* (PCPA) as pesticides of the Manufacturing Class for use only in the manufacture of a pest control product or a product regulated under the *Fertilizers Act*.
2,3,4	Designated under the PCPA as pesticides of the Commercial Class for use in commercial activities that are specified on the label or Restricted Class when the label specifies essential conditions respecting the display, distribution or limitations on the use of, or qualifications of persons who may use the product.
5,6,7	Designated under the PCPA as pesticides of the Domestic Class to be distributed primarily to the general public for personal use in or around their homes.
8	Banned for sale in Ontario.
9	Banned for use in, on or over land unless their use is excepted.
10	Are allowed for use under the promotion of public health or safety exception.
11	Require a "green" notice sign be posted for the purposes of providing public notice when products containing these ingredients are used by any person on non-residential area land and by a licensed exterminator on residential area land in performing land exterminations.

* Detailed descriptions of each classification can be found at: ontario.ca/page/pesticide-licences-and-permits.

Notes on Herbicides

Read these notes together with the information provided in other chapters throughout this publication. Additional information on use, toxicity and safety precautions is given here. Herbicides are listed by their common (chemical) name rather than their trade (product) name. See Table 4–1. *Herbicides Used in Ontario,* page 30, to determine the corresponding common name for a particular trade name. For example, Table 4–1 indicates that the trade name AATREX has a common name of atrazine; notes on AATREX are listed under atrazine in this section. See Chapter 5, Notes on Adjuvants, page 81, for information on adjuvants.

Complete information on each herbicide is available on the product label located on the herbicide container. The federal Pest Management Regulatory Agency also lists pesticide labels on their website bit.ly/herbicidelabels. Many herbicide manufacturers also list product labels and/or Material Safety Data Sheets (MSDS) on their websites listed on page 455 of this publication.

2,4-D

Trade Names: 2,4-D AMINE 600, 2,4-D ESTER 700.

Chemical Family: Phenoxy.

Crop and/or Non-Crop Registrations: Cereals, turf, pastures, non-cropland, asparagus, field corn, soybeans (preplant only), high bush blueberries, cranberries, raspberries, strawberries, bearing fruit trees including apple, pear, peach, plum, apricot and cherries, potato (preharvest) and brush.

Sensitive Weeds: annual sow-thistle, bluebur, cocklebur, daisy fleabane, false flax, flixweed, goat's beard, kochia, lamb's-quarters, mustards, plantain, prickly lettuce, ragweeds, redroot pigweed, Russian pigweed, Russian thistle, shepherd's purse, stinging nettle, stinkweed, sweet clover, wild radish and wild sunflower. A number of other broadleaf and woody species are listed as less susceptible or for top growth control only.

Uptake and Translocation: Readily absorbed through leaves or roots. Translocated primarily in phloem with the sugars but can also move with water in the xylem. Accumulation is primarily in the young, rapidly growing meristematic regions of roots or shoots.

Basis of Selectivity: Differences in interception, penetration, translocation, metabolism and sensitivity of active sites lead to greater activity on broadleaf weeds compared to grasses.

Application Methods: Postemergence (broadleaf weeds), stem-foliage or stem-basal (brush).

Residual Activity: Half-life in soil is usually not longer than 1 or 2 weeks during the growing season due to rapid decomposition by soil micro-organisms.

Unique Characteristics: All weeds are more easily killed when growing rapidly in moist soil. Unfortunately, some broadleaf crops, garden and ornamental plants are as sensitive to 2,4-D as many weeds and only a trace of the chemical as spray drift, vapour drift or contaminant in soil or water may cause serious damage. Even crops that can be sprayed safely can be sensitive at some stages of growth or at excessive application rates; thus follow label precautions carefully. Amines and esters are the most common formulations of 2,4-D. The esters are the most active and can be used at the lower rates and for brush control. Since vapour drift is a potential problem with the ester formulations, use only amines on lawns, or near gardens or susceptible crop areas. Low volatile esters can be used by agriculturists or licenced applicators in areas where risk of damage to sensitive non-target vegetation is low.

2,4-D/DICAMBA/MECOPROP-P

Trade Names: KILLEX 500, PAR III, PREMIUM 3-WAY XP, TRI-KIL, TRILLION-P LIQUID TURF HERBICIDE, WEEDAWAY XP TURF HERBICIDE.

Chemical Family: Phenoxy/benzoic acid/phenoxy.

Crop and/or Non-Crop Registrations: Turf.

Sensitive Weeds: At field-crop rates: wild buckwheat, lady's-thumb, green smartweed, Russian thistle, sow-thistle, hedge bindweed, corn spurry, knotweed, volunteer cultivated buckwheat, common ragweed, cocklebur, stinkweed, mustards, prostrate pigweed, redroot pigweed and lamb's-quarters. At non-cropland rates, a wide range of broadleaf weeds including bull thistle, chicory, goat's beard, ragwort, white cockle, poison-ivy, alder and sheep-laurel.

Application Method: Postemergence when weeds are small and actively growing.

Unique Characteristics: This mixture controls a wider spectrum of weeds than any of the herbicides alone.

2,4-DB

Trade Names: COBUTOX, EMBUTOX, CALIBER.

Chemical Family: Phenoxy.

Crop and/or Non-Crop Registrations: Seedling alfalfa, bird's-foot trefoil, clovers (except sweet) direct seeded or underseeded in spring wheat, barley or oats and corn.

Sensitive Weeds: Many small broadleaf weeds such as stinkweed, ragweed, lamb's-quarters, wild buckwheat and mustards. Top-growth control of Canada thistle, field bindweed and perennial sow-thistle.

Uptake and Translocation: Absorbed through the foliage and readily translocated to the growing points.

Basis of Selectivity: Sensitive weeds rapidly convert 2,4-DB into 2,4-D; tolerant species do not make this conversion under normal conditions.

Application Method: Postemergence.

Residual Activity: None.

Unique Characteristics: Mustards are not usually controlled by 2,4-DB alone if sprayed beyond the 4 leaf stage; a tank-mixture with MCPA will improve control of these larger mustards. Injury to alfalfa increases under drought stress or when alfalfa seedlings have more than 4 trifoliate leaves.

ACETIC ACID

Trade Name: ECOCLEAR, MUNGER HORTICULTURAL VINEGAR PLUS.

Chemical Family: Not assigned.

Crop and/or Non-Crop Registrations: Non-crop, right-of-way and industrial land sites.

Sensitive Weeds: Annual broadleaf and grassy weeds including ragweed, chickweed, lamb's-quarters and black medic. Suppression of perennial weeds including dandelion, plantain spp., clover spp., wild carrot, toadflax, quackgrass, tufted vetch, hawkweed spp. and curled dock.

Basis of Selectivity: Non selective.

Application Methods: Postemergence spray when weeds are small and actively growing. ECOCLEAR is a contact herbicide, thorough coverage is necessary to achieve desirable control. ECOCLEAR can be used as a spot treatment or as a broadcast application. For broadcast application apply 750–1,250 L of final solution/ha.

Residual Activity: Non-residual.

Unique Characteristics: ECOCLEAR works very quickly. Complete control can be achieved in as little as 24 hours. Weeds that are mature, dormant or hardened due to moisture stress tend to be more tolerant to treatment with ECOCLEAR.

ACIFLUORFEN

Trade Name: BLAZER.

Chemical Family: Diphenyl ether.

Crop and/or Non-Crop Registrations: Soybeans.

Sensitive Weeds: Annual broadleaf weeds including: cocklebur, jimsonweed, lady's-thumb, lamb's-quarters, wild mustard, redroot pigweed, common ragweed and eastern black nightshade. Suppression of perennial weeds including: Canada thistle, hedge bindweed, field bindweed and common milkweed.

Uptake and Translocation: Taken up through the foliage. Not readily translocated.

Basis of Selectivity: Metabolism by tolerant species.

Application Methods: Postemergence when weeds are small and actively growing. Apply in 200–400 L/ha of water with a pressure of 275–400 kPa. Soybeans are tolerant after the first trifoliate-leaf stage. Thorough coverage is necessary. Do not add adjuvants to acifluorfen applied at the full rate.

Residual Activity: None.

Unique Characteristics: Acifluorfen is not volatile. Significant crop injury can be expected if acifluorfen is applied during hot, humid weather or if the crop is stressed due to previous herbicide injury, flooding, drought or cold conditions prior to the application. Cool weather or drought may delay control. Rainfall within 6 hours after application may reduce effectiveness.

ADJUVANT

See Chapter 5, *Notes on Adjuvants*, page 81.

AMINOPYRALID

Trade Name: MILESTONE HERBICIDE.

Chemical Family: Pyridine.

Crop and/or Non-Crop Registrations: Rangeland, grass pastures, industrial and other non-crop areas of Canada.

Sensitive Weeds: Milestone used alone controls: Canada thistle, spotted knapweed, Canada goldenrod, scentless chamomile, absinth wormwood, common tansy. MILESTONE can be tank mixed with 2,4-D amine for control of western snowberry, dandelion, annual sow-thistle, bluebur, bull thistle, burdock, buttercup, cocklebur, common plantain, curled dock, flixweed, goat's beard, hawkweed, hoary cress, peppergrass, perennial sow-thistle, prickly lettuce, stinging nettle, sweet clover and wild carrot.

Uptake and Translocation: Herbicide taken up primarily through the foliage, but also has soil residual activity on roots, seedlings and seeds. Strong translocation.

Basis of Selectivity: Metabolized by tolerant species.

Application Methods: Postemergence when weeds are small and actively growing. Apply with ground equipment in minimum of 100 L/ha or aerial equipment in a minimum of 19 L/ha spray volumes. Good coverage is necessary.

Residual Activity: Short term soil residual activity that will control most species for two years.

Unique Characteristics: MILESTONE has no grazing restriction on livestock or lactating dairy animals grazing in treated areas. Allow 3 days of grazing on untreated pasture or untreated hay before transferring livestock to areas were sensitive broadleaf crops may be grown. Do not move manure compost containing MILESTONE onto sensitive crops, flowers, gardens, etc. Use only on well established forage grasses (secondary root development). MILESTONE Herbicide will kill legume plants including alfalfa and clover in tame pastures. Use adequate buffer zones from sensitive crops and do not allow product spray to drift off site onto sensitive crops. Do not plant legumes crops on treated land for 48 months after application. Clean spray equipment throughly after use, before using spray equipment for other applications to sensitive crops. MILESTONE Herbicide cannot be applied on domestic or commercial turf grass. Rainfast period is 2 hours.

AMINOPYRALID/METSULURON-METHYL

Trade Name: CLEARVIEW HERBICIDE.

Chemical Family: Pyridine and sulfonylurea.

Crop and/or Non-Crop Registrations: Rangeland, permanent pastures, rights-of way, industrial and other non-crop areas of Canada.

Sensitive Weeds (135 g/ha): Ball mustard, bluebur, Canada fleabane, Canada thistle, chickweed, clover, common groundsel, common ragweed, common tansy, corn spurry, cow cockle, dandelion, field scabious, flixweed, green smartweed, hempnettle, horsenettle, kochia, lady's thumb, musk or nodding thistle, narrow-leaved hawksbeard, ox-eye daisy, perennial sow-thistle, plumeless thistle, prostrate pigweed, Russian thistle, scentless chamomile, shephard's purse, spotted knapweed, stinkweed, stork's bill, sweet clover, tall buttercup, tartary buckwheat, volunteer canola, western snowberry, wild mustard, yellow starthistle.

Uptake and Translocation: Herbicide taken up primarily through the foliage, but also has soil residual activity on roots, seedlings and seeds. Strong -translocation.

Basis of Selectivity: Metabolized by tolerant species.

Application Methods: Postemergence when weeds are actively growing. Apply with ground equipment in minimum of 110 L/ha or aerial equipment in a minimum of 30 L/ha spray volumes. Good coverage is necessary.

Residual Activity: Short term soil residual activity that will control most species for two years.

Unique Characteristics: There is no restriction on livestock or lactating dairy animals grazing in treated areas. Allow 3 days of grazing on untreated pasture or untreated hay before transferring livestock to areas where sensitive broadleaf crops may be grown. Do not move manure compost containing CLEARVIEW onto sensitive crops, flowers, gardens, etc. Use only on well established forage grasses (secondary root development). CLEARVIEW Herbicide will kill legume plants including alfalfa and clover in tame pastures. Use adequate buffer zones from sensitive crops and do not allow product spray to drift off site onto sensitive crops. Do not plant legumes crops on treated land for 48 months after application. Clean spray equipment throughly after use, before using spray equipment for other applications to sensitive crops. CLEARVIEW Herbicide cannot be applied on domestic or commercial turf grass. Rainfast period is 2 hours.

AMITROLE

Trade Name: AMITROL 240.

Chemical Family: Triazole.

Crop and/or Non-Crop Registrations: Spruce bareroot nursery stock.

Sensitive Weeds: Many annual broadleaf weeds and grasses.

Uptake and Translocation: Absorbed by foliage and roots. Translocates well in xylem and phloem. Accumulates in growing regions of plant.

Basis of Selectivity: Resistant plants metabolize amitrole more rapidly than sensitive plants and may have lower uptake as a result of leaf structure that reduces wetting and penetration.

Application Methods: Application can be made in the first year in seedbeds, but only after the seedlings have set bud.

Residual Activity: Approximately 2–4 weeks in moist, warm soil.

Unique Characteristics: Most crops are sensitive if contacted.

ATRAZINE

Trade Names: AATREX LIQUID 480, CONVERGE 480.

Chemical Family: S-triazine.

Crop and/or Non-Crop Registrations: Corn (ensilage, field, seed and sweet).

Sensitive Weeds: Will control a wide range of broadleaf weeds such as mustards, purslane, ragweed, smartweed, lady's-thumb, wild buckwheat, lamb's-quarters, pigweed, wild oats and volunteer clover. Populations of lamb's-quarters, pigweed, wild oats and ragweed have been found that are resistant to atrazine and are therefore not controlled.

Uptake and Translocation: Actively absorbed by roots and foliage, although foliar absorption is usually small. It is translocated to the top of the plant and accumulates in the leaf margins and the growing points.

Basis of Selectivity: Metabolism by tolerant species.

Application Methods: For corn, preplant incorporated, preemergence, or postemergence (with or without oil) usually before the annual weeds are more than 4 cm high; under dry weather conditions a shallow incorporation may enhance activity; oil or oil/surfactant blends will increase the postemergence activity.

Residual Activity: Can persist in the soil for varying lengths of time depending on rate, weather and soil conditions (longer under dry, cool weather conditions and in sandy soils). Postemergence treatments tend to persist longer than preemergence treatments. Refer to Tables 4–4 and 4–5. *Herbicide Crop Rotation and Soil pH Restrictions,* page 74 and page 76, for information on rotational crop restrictions.

BENSULIDE

Trade Name: BETASAN, PREFAR 4.8-E.

Chemical Family: Benzenesulfonamide.

Crop and/or Non-Crop Registrations: Lawns, turf and cucumbers.

Sensitive Weeds: Germinating annual grasses such as annual bluegrass, barnyard grass, crabgrass and foxtail. Some control of redroot pigweed, lamb's-quarters and shepherd's-purse.

Uptake and Translocation: Adsorbed on root surfaces and a small amount is absorbed by the roots. Little or none is translocated upward to the leaves.

Basis of Selectivity: Inhibits root growth and partially inhibits cell division in sensitive seedlings. Sensitive species affected only in seedling stage. Metabolized by established grasses.

Application Methods: Preemergence in spring or fall for turf (well-established only); a higher rate is required for fall applications to control germinating weeds the following spring; incorporate by lightly irrigating into soil.

Residual Activity: Season-long weed control. Degraded slowly by soil micro-organisms with a half-life of 4–6 months depending on soil type. Because of soil residues, only cucurbits, cole crops, carrots, lettuce, peppers and tomatoes should be planted the following year.

Unique Characteristics: Bensulide is inactivated in soils containing high amounts of organic matter (muck soils). Bensulide should be incorporated into the soil to avoid photodecomposition. Do not reseed turf within 1 year of application.

BENTAZON

Trade Names: BASAGRAN FORTÉ, BASAGRAN.

Chemical Family: Benzothiadiazine.

Crop and/or Non-Crop Registrations: BASAGRAN FORTÉ AND BASAGRAN: Corn (field, seed and sweet), dry beans (refer to Table 7–1. *Beans (Adzuki, Dry, Lima and Snap) Weed Control Ratings,* page 101), faba beans, flax, millet, peas, sorghum and soybeans, BASAGRAN specific registrations: highbush blueberries, new plantings of apples, apricots, cherries, peaches, pears, turf, alfalfa, red clover, alsike clover, sainfoin, bromegrass, crepping red fescue, meadow foxtail, orchardgrass, timothy, crested wheatgrass.

Sensitive Weeds: Annual broadleaf weeds including hairy nightshade, lamb's-quarters, redroot pigweed, low cudweed, purslane, common ragweed, wild radish, Russian thistle, hairy galinsoga, corn spurry, bird rape, flower-of-an-hour, buttercups, common groundsel, jimsonweed, giant ragweed, velvetleaf, lady's-thumb, wild mustard, cocklebur, stinkweed, shepherd's-purse and common chickweed. Triazine-tolerant biotypes of lamb's-quarters, redroot pigweed, common ragweed and common groundsel are also controlled. Top growth of Canada thistle and nutsedge are controlled. Field bindweed may be suppressed by 2 applications applied 10 days apart.

Uptake and Translocation: Taken up through the foliage. Not translocated.

Basis of Selectivity: Metabolism by tolerant species.

Application Methods: Postemergence when weeds are small and actively growing. Apply in 100–400 L water/ha. Crop must be in a tolerant growth stage (see specific recommendations on label). Thorough spray coverage is necessary. Liquid ammonium sulphate or 28% urea ammonium nitrate may be added to BASAGRAN FORTÉ or BASAGRAN for improved and more consistent control of velvetleaf and lamb's-quarters in soybeans only. BASAGRAN FORTÉ does not require additional adjuvants.

Residual Activity: None.

Unique Characteristics: Corn and turf are tolerant at all stages of growth. Bentazon is not volatile. Temporary crop injury can be expected if bentazon is applied during hot, humid weather or if crop is stressed (flooding, drought, cold). Cool weather or drought may delay control. Rainfall within 6–8 hours after application may reduce effectiveness. Since there is no residual activity, a new flush of weeds may emerge after the first flush has been controlled.

BROMACIL

Trade Names: HYVAR X-L.

Chemical Family: Uracil.

Crop and/or Non-Crop Registrations: Non-cropland for total vegetation control and as a spot treatment to control brush.

Sensitive Weeds: Annual and perennial broadleaf weeds and grasses (broadcast application). Several brush species (spot application).

Uptake and Translocation: Most readily absorbed through the roots. Surfactants can enhance foliar activity. Translocation is upward with the movement of water to leaves where it inhibits photosynthesis.

Basis of Selectivity: Non-selective at normal rates.

Application Methods: For herbaceous weeds, broadcast sprayed, preferably just before or during periods of active weed growth. For brush, spot applications with an exact-delivery handgun sprayer either at the base of target brush or on a grid.

Residual Activity: Half-life is 5–6 months for 4.4 kg/ha bromacil in a silty loam soil.

Unique Characteristics: Do not use Bromacil where it is likely to leach, wash or move with eroded soil into contact with the roots of desirable trees and shrubs. Do not apply to brush growing in water.

BROMACIL/DIURON

Trade Name: KROVAR.

Chemical Family: Uracil/substituted urea.

Crop and/or Non-Crop Registrations: Non-cropland.

Sensitive Weeds: Most herbaceous weeds.

Basis of Selectivity: Non-selective.

Application Method: Broadcast spray just before or during the period of active weed growth.

Unique Characteristics: Normally fewer species of weeds escape or regrow after use of this mixture compared to use of the same amount of either chemical alone. Also see notes on BROMACIL and DIURON.

BROMOXYNIL

Trade Name: BROMOTRIL, BROMAX 480, BROTEX 240, BROTEX 480, KORIL, PARDNER.

Chemical Family: Hydroxybenzonitrile.

Crop and/or Non-Crop Registrations: Alfalfa (seedling, established-seed), barley, canary grass (seed), corn, dry bulb onions, fall rye, flax, garlic, oats, millet, sorghum, triticale, and wheat (Durum, spring, winter).

Sensitive Weeds: Smartweed, nightshade, velvetleaf, pigweed, common ragweed, cocklebur, stinkweed, and wild mustard are killed if the chemical thoroughly contacts these plants before they have more than 4 true leaves: wild buckwheat and lamb's-quarters control to 8 leaf. Most established perennial broadleaf weeds, chickweed and grasses tolerate typical field rates of this herbicide.

Uptake and Translocation: Absorbed by plant foliage and moves very little within the plant.

Basis of Selectivity: Differential spray retention, uptake, translocation and degradation.

Application Method: Postemergence.

Residual Activity: Essentially no soil residual activity.

Unique Characteristics: Crop injury symptoms (leaf scorch) may develop if the plant is under stress within 2 or 3 days before or after spraying; this stress could be caused by high temperatures or high humidity or, in the case of corn, application following a period of cool, wet weather; such injury usually does not affect yields. Although bromoxynil is not an effective soil-applied herbicide, broadleaf crops such as turnips, peas and beans should not be seeded for a week after spray application.

BROMOXYNIL/MCPA

Trade Names: BADGE, BUCTRIL M, LOGIC M, MEXTROL.

Chemical Family: Hydroxybenzonitrile/phenoxy.

Crop and/or Non-Crop Registrations: Spring and winter wheat, barley, oats, flax, fall rye, corn, timothy hay and canary grass.

Unique Characteristics: Combination of bromoxynil with MCPA provides better control of mustards than bromoxynil alone. Also see notes on BROMOXYNIL and MCPA.

CARFENTRAZONE-ETHYL

Trade Name: AIM EC.

Chemical Family: Aryl triazolinone.

Crop and/or Non-Crop Registrations: Preplant burndown (all crops except tobacco, asparagus, ginseng, nursery stock and turfbeds); hooded sprayer applications (for use in root, tuber, bulb, legume, fruiting and leafy vegetables, pome and stone fruits and berries – refer to product label for specific crop registrations); harvest aid treatment for potatoes, dry beans, soybeans and cereals.

Sensitive Weeds: 36.5 mL/ha rate – redroot pigweed, velvetleaf. 58 mL/ha rate – lamb's-quarters, mallow, hairy nightshade, field pennycress, pigweed (prostrate, smooth and tumble), purslane, smartweed, tall waterhemp, tansy mustard. 73 mL/ha rate – carpetweed, cocklebur, eastern black nightshade, jimsonweed, kochia, volunteer canola. 117 mL/ha rate – burclover, prickly lettuce and corn spurry.

Uptake and Translocation: Carfentrazone-ethyl is taken up through the foliage and not readily translocated.

Basis of Selectivity: Metabolism.

Application Methods: Coverage of the weeds is essential for good control. For dessication, apply when the crop is mature and the grain has begun to dry down.

Residual Activity: None.

Unique Characteristics: AIM EC is a non-residual product and will not injure subsequent crops.

CARFENTRAZONE-ETHYL + PYROXASULFONE

Trade Name: FOCUS.

Chemical Family: isoxazoline/Aryl triazolinone.

Crop Registrations: Field corn.

Sensitive Weeds: barnyardgrass, crabgrass, giant, green and yellow foxtail and tall waterhemp.

Application Methods: Surface preplant and preemergence in field corn. Rainfall within 10 days is required for maximum activity of the preemergence application.

CHLORIMURON-ETHYL

Trade Name: CLASSIC, CLASSIC GRANDE, CHAPERONE.

Chemical Family: Sulfonylurea.

Crop and/or Non-Crop Registrations: Soybeans.

Sensitive Weeds: Common ragweed, dandelion, lamb's-quarters, prickly lettuce, redroot pigweed, velvetleaf and yellow nutsedge.

Uptake and Translocation: Following foliar application, chlorimuron is rapidly absorbed through the leaves and translocated in both xylem and phloem.

Basis of Selectivity: Inhibition of acetolactate synthase (ALS) enzyme in susceptible plants leads to a rapid cessation of cell division and growth. Tolerant species rapidly convert chlorimuron to non-phytotoxic metabolites.

Application Methods: Postemergence. Preplant or post plant for control of dandelion.

Residual Activity: Chlorimuron-ethyl will provide some residual activity after application.

Unique Characteristics: A non-ionic surfactant must be added at 0.2% v/v. 28% Urea ammonium nitrate (U.A.N.) at 2 L/ha will improve the control of velvetleaf. Typical symptoms of plant death (chlorosis, necrosis) may occur from 1–3 weeks after application, depending on growing conditions. Favourable growing conditions will speed the activity while cool or dry conditions will delay it.

CHLORIMURON-ETHYL + FLUMIOXAZIN

Trade Name: STEP UP (co-pack of CHAPERONE and VALTERA).

Chemical Family: Sulfonylurea, Dicarboxamide.

Crop and/or Non-Crop Registrations: Preplant to soybeans.

For All Other Information: Refer to chlorimuron-ethyl and flumioxazin alone.

CHLORIMURON-ETHYL + GLYPHOSATE

Trade Name: GUARDIAN (co-pack of CLASSIC and POLARIS).

Chemical Family: Sulfonylurea, Dicarboxamide, Amino acid.

Crop and/or Non-Crop Registrations: Preplant to Soybeans. Postemergence only to glyphosate tolerant ("Roundup Ready") soybean varieties.

Sensitive Weeds: Season long control of dandelion (preplant). Season long control of annual sow-thistle, dandelion and yellow nutsedge (post).

For All Other Information: Refer to chlorimuron-ethyl and glyphosate alone.

CHLORIMURON-ETHYL + FLUMIOXAZIN + GLYPHOSATE

Trade Name: GUARDIAN PLUS II (co-pack of GUARDIAN PLUS II and POLARIS).

Chemical Family: Sulfonylurea, Dicarboxamide, Amino acid.

Crop and/or Non-Crop Registrations: Preplant to soybeans.

For All Other Information: Refer to chlorimuron-ethyl, flumioxazin and glyphosate alone.

CHLORIMURON-ETHYL + IMAZETHAPYR

Trade Name: FREESTYLE (co-pack of CLASSIC and DUPONT IMAZETHAPYR).

Chemical Family: Sulfonylurea, imidazolinone.

Crop and Non-Crop Registrations: Soybeans. Preplant or pre-emergence.

For All Other Information: refer to chlorimuron-ethyl and imazethapyr alone.

CHLORIMURON-ETHYL + METRIBUZIN

Trade Name: CANOPY PRO (co-pack of CLASSIC and TRICOR 75 DF).

Chemical Family: Sulfonylurea, imidazolinone.

Crop and Non-Crop Registrations: Soybeans. Preplant or pre-emergence.

For All Other Information: Refer to chlorimuron-ethyl and metribuzin alone.

CHLORSULFURON

Trade Name: TELAR.

Chemical Family: Sulfonyl urea.

Crop and/or Non-Crop Registrations: Non-cropland.

Sensitive Weeds: Annual and perennial broadleaf weeds such as wild carrot, Canada thistle, sow-thistle, scentless chamomile, lamb's-quarters, wild mustard, redroot pigweed, stinkweed, cow cockle, chickweed and Russian thistle.

Uptake and Translocation: Thoroughly systemic after absorption of either foliage or roots. Foliar absorption is rapid.

Basis of Selectivity: A disruption of amino acid metabolism leads to an inhibition of cell division in sensitive plants. Faster rates of metabolic detoxification have been observed in tolerant species.

Application Methods: Preemergence or early postemergence.

Residual Activity: Half-life is 4–6 weeks under growing season conditions. Degradation is faster with higher soil temperatures and/or lower soil pH.

Unique Characteristics: Although degradation is moderately rapid, extremely low residues can be highly toxic to some broadleaf weeds, such as wild carrot, for up to 2 years after application. Use of this product requires a surfactant.

CHLORSULFURON/AMINOCYCLOPYRACHLOR

Trade Name: TRUVIST HERBICIDE.

Chemical Family: Sulfonylurea/pyrimidine carboxylic acids.

Crop and/or Non-Crop Registrations: Industrial non-crop sites.

Sensitive Weeds: Bladder campion, Bluebur, Buttercup (Tall, Giant, Bulbous, Hairy, Small-flowered), Canada thistle, Common chickweed, Common groundsel, Common tansy, Common yarrow, Corn spurry, Cow cockle, Dandelion, Field bindweed, Field horsetail Fleabane (Canada), Fleabane (Annual), Flixweed, Giant hogweed, Goldenrod (Canada, Common), Green smartweed, Halogeton, Hawkweed (Orange, Yellow), Hemp nettle, Knapweed (Diffuse, Spotted), Knotweed (Silversheath, Prostrate, Common, Erect), Kochia (including Group 2 resistant), Kudzu, Lady's thumb, Lamb's quarters, Leafy spurge, Nodding (Musk, Plumeless, Spiny Plumeless) Thistle, Ox-eye daisy, Pasture sage, Perennial, pepperweed, Plantain species, Poison ivy, Prickly lettuce, Ragweed (Common, Giant, Western), Redroot pigweed, Russian thistle, Scentless chamomile, Shepherd's purse, Skeletonweed, Smooth bedstraw, Sow thistle (Annual and Perennial), Stinkweed, Stork's bill, Sumac (Smooth, Staghorn), Sweet clover (White, Yellow), Volunteer canola, White cockle, Wild buckwheat, Wild carrot, Wild chervil, Wild mustard, Wild parsnip, Wild rose, Yellow starthistle, Willow species (Pussy, Sandbar, Ditchbank), Snowberry (Western).

Application Methods: Apply to young emerged weeds that are actively growing.

Residual Activity: Provides residual control that will generally result in season long control of sensitive weeds

CHLORTHAL DIMETHYL

Trade Name: DACTHAL W-75.

Chemical Family: Phthalate.

Crop and/or Non-Crop Registrations: Broccoli, Brussels sprouts, cabbage, cauliflower, dry and snap beans, eggplant, established ornamentals, garlic, turf, onions, peppers, potatoes, seeded melons, soybeans, strawberries, sweet potatoes, tomatoes, woody nursery stock.

Sensitive Weeds: Germinating annual grasses and certain annual broadleaf weeds such as lamb's-quarters, purslane, common chickweed, redroot pigweed, carpetweed and groundcherry.

Uptake and Translocation: Absorbed by roots but not foliage. Does not translocate within the plant.

Basis of Selectivity: Inhibits growth of germinating seeds; exact mechanism not yet known.

Application Method: Must be applied prior to weed seed germination. Depending on the crop, may be applied preplant incorporated, preemergence, postemergence or post transplant to crop. At least 1 cm of water as either rain or irrigation is necessary to activate the herbicide. In turf, spring or fall application is satisfactory.

Residual Activity: Average half-life is 100 days in most general soil types. Effective weed control may be maintained for as long as 2 months, depending on application rate and soil type.

Unique Characteristics: May be applied over the top of most plants with no phytotoxic effects. Has little herbicidal activity on velvetleaf, common ragweed, wild mustard, jimsonweed, galinsoga, smartweed, nutsedge and cocklebur. Established turf fields (with the exception of the bent grasses) have good tolerance. Turf should not be reseeded for 60 days after treatment. Use only on mineral soils.

CITRIC ACID + LACTIC ACID

Trade Name: KONA.

Crop and/or Non-Crop Registrations: Lawns and turf.

Sensitive Weeds: Partial suppression of white clover, red clover, bird's-foot trefoil, black medic and wood sorrel.

CLETHODIM

Trade Name: ARROW, SELECT.

Chemical Family: Cyclohexanedione.

Crop and/or Non-Crop Registrations: Basil, Blueberries, canola, chickpeas (Desi and Kabuli), caraway, coriander, cranberries, field peas, flax, a number of different edible bean market classes, refer to Table 7–1. *Beans (Adzuki, Dry, Lima and Snap) Weed Control Ratings*, page 101 for specific crop registrations, lentils, mustard greens, safflower, soybeans, spinach, sunflowers, dry onions, and potatoes.

Sensitive Weeds: Annual grasses (wild oats, green and yellow foxtail, volunteer cereals, volunteer corn and barnyard grass).

Uptake and Translocation: Uptake through the foliage and translocated through both the phloem and xylem throughout the plant accumulating in the meristemic regions both above and below the ground.

Basis of Selectivity: Tolerant plants rapidly metabolize clethodim to several conjugated metabolites.

Application Method: Postemergent to actively growing grasses in the 2–6 true-leaf stage.

Residual Activity: Rapid degradation in both soil and water with no soil activity.

Unique Characteristics: Highly active on all annual grasses and volunteer cereals at one low dose rate of 0.19 L/ha in a tank-mix with the adjuvant CC-16255.

CLOMAZONE

Trade Names: COMMAND 360 ME.

Chemical Family: Isoxazolidinone.

Crop and/or Non-Crop Registrations: Field cucumber, melons, processing pumpkins, squash, soybeans, sweet potatoes and peppers.

Sensitive Weeds: Velvetleaf, lamb's-quarters, lady's thumb, eastern black nightshade, barnyardgrass, green foxtail, yellow foxtail.

Uptake and Translocation: Primarily absorbed through the roots and is translocated through the xylem in the plant.

Basis of Selectivity: Clomazone is metalized in soybeans.

Application Methods: Preemergence.

Residual Activity: When applied at labelled rates, Command 360 ME will provide season long weed control. It is relatively immobile in soil and microbial decomposition is the principle path of dissipation. Some rotational restrictions apply, refer to Tables 4–4 and 4–5. *Herbicide Crop Rotation and Soil pH Restrictions*, page 74 and page 76, for more information. Soil texture impacts residual and product efficacy, see product label for appropriate rates.

Unique Characteristics: Sensitive plants in the application zone will turn white (bleached) as carotenoid biosynthesis is inhibited .

CLOPYRALID

Trade Names: LONTREL 360.

Chemical Family: Pyridine.

Crop and/or Non-Crop Registrations: Strawberries, highbush blueberries, apples, apricots, cherries, nectarines, peach, plum, cranberries, sugar beets, rutabagas, cole crops (cabbage, cauliflower, broccoli, asian cole crops), canola, barley, oats, wheat, control of broadleaf weeds in rights-of-way (hydro, railroad, communication lines, pipelines) and associated stations, industrial manufacturing sites, storage sites and roadsides, airports, military bases and low maintenance, rough-turf areas, rangeland, grass pasture and balsam fir Christmas tree stands or plantations.

Sensitive Weeds: Will control or suppress certain annual and perennial weeds including Canada thistle, goldenrod, ox-eye daisy, tufted vetch, sheep sorrel, dandelion and wild buckwheat, scentless chamomile, groundsel, ragweed, coltsfoot and spotted knapweed.

Uptake and Translocation: Rapidly absorbed by foliage and translocated readily throughout the plant via both xylem and phloem systems. Clopyralid is distributed throughout the plant to the meristem.

Basis of Selectivity: Effects on nucleic acid metabolism and growth are not observed in grasses and other tolerant species.

Application Methods: Postemergence as a broadcast or selective foliar.

Residual Activity: Half-life in soil is less than 30 days under conditions that are favourable for microbial degradation. Little to no residual activity.

Unique Characteristics: Clopyralid has little to no activity on woody vegetation, except woody species of the legume family.

CLORANSULAM-METHYL

Trade Name: FIRSTRATE.

Chemical Family: Triazolopyrimidine sulfonanilide.

Crop and/or Non-Crop Registrations: Soybeans.

Sensitive Weeds: Common ragweed, cocklebur, velvetleaf, and lamb's-quarters (Pre). Cocklebur, common ragweed, giant ragweed, jimsonweed and velvetleaf (Post).

Uptake and Translocation: Absorption by roots, shoots and foliage. Translocation via the xylem and phloem and accumulation in the growing points.

Basis of Selectivity: Metabolism by soybeans. Inhibition of the acetolactase synthase (ALS) enzyme in susceptible plants followed by a rapid cessation of cell division and plant growth.

Application Methods: Preemergence in both conventional and conservation tillage systems or postemergence prior to the flowering stage of soybeans.

Residual Activity: Decomposition in soils is attributed primarily to microbial degradation. Some rotational cropping restrictions apply. Refer to Tables 4–4 and 4–5, *Herbicide Crop Rotation and Soil pH Restrictions*, on page 74, and page 76 for additional information.

Unique Characteristics: Do not apply to peat or muck soils. Preemergence or postemergence applications require an activating rainfall that moistens the soil to a depth of at least 5 cm in order to move FIRSTRATE into the weed germination zone. If adequate rainfall is not received within 7–10 days after application, a shallow cultivation or use of a rotary hoe is suggested. Do not apply when air temperature is near freezing or when freezing conditions are expected for several days following time of application. Extended cold, wet conditions or abnormally high soil moisture conditions during emergence and early crop development may cause injury symptoms on soybeans such as temporary yellowing of the leaves and/or crop stunting. Soybeans will quickly outgrow these symptoms once normal growing conditions resume. Postemergence application prior to full emergence of the first trifoliate leaf may cause temporary yellowing of soybeans. This effect is transient and has no effect on soybean yields. Postemergence application requires the addition of a non-ionic surfactant (Agral 90) and a liquid ammonium fertilizer (28-0-0 or 32-0-0). See label for details.

COPPER SULPHATE

Trade Name: POLYDEX ALGAECIDE MC, POLYDEX ALGAECIDE, POLYPRO, POND WIZARD ALGAECIDE, THINK PURITY ALGAECIDE SOLUTION, THINK PURITY ALGAECIDE AND ODOUR CONTROL SOLUTION, TRIANGLE BRAND COPPER SULPHATE – Contact manufacturer for more information.

CORN GLUTEN MEAL

Trade Name: TURFMAIZE.

Chemical Family: TURFMAIZE is a non-chemical product.

Crop and/or Non-Crop Registrations: Established Kentucky bluegrass.

Sensitive Weeds: Inhibits germination of smooth crabgrass and dandelion.

Uptake and Translocation: Not available.

Application Methods: Applied before smooth crabgrass and dandelion germination to established Kentucky blue-grass turf in the spring, late summer or fall.

DAZOMET

Trade Name: BASAMID.

Chemical Family: Dithiocarbamate.

Crop and/or Non-Crop Registrations: Field and greenhouse vegetable seedbeds for eggplant, lettuce, pepper and tomato; fall treatment only of tobacco greenhouse seedbeds; forest nurseries, seed or propagation beds (field, greenhouse) for conifer, deciduous, ornamentals; field and greenhouse seed and planting beds for annual flowers; turf seedbeds.

Sensitive Weeds: Most germinating weed seeds.

Uptake and Translocation: Breaks down on contact with soil moisture and releases toxic gases that control germinating weed seeds.

Basis of Selectivity: Non-selective. Chemical must be completely dissipated from the seedbed before planting or injury may occur. Breaks down on contact with soil moisture and releases toxic gases that control germinating weed seeds.

Application Methods: Apply granular product to a well-worked seedbed and incorporate evenly. Seal soil immediately after incorporation by rolling and flooding or by covering with heavy polyethylene plastic and sealing edges. After a waiting period of 10–40 days, depending on soil temperature, aerate the soil. Conduct a safety germination test before using treated soil. Do not use when soil temperature is below 6°C.

Residual Activity: Depends on the rate applied, soil moisture and soil temperature. The gases are toxic to all growing plants and a safety germination test must be carried out to determine that the soil is safe for planting.

Unique Characteristics: Also controls unencysted nematodes and soil fungi.

DESMEDIPHAM/PHENMEDIPHAM

Trade Name: BETAMIX B.

Chemical Family: Phenylcarbamate.

Crop and/or Non-Crop Registrations: Red garden beets, sugar beets and newly-planted June-bearing strawberry (transplanted strawberries).

Sensitive Weeds: Pigweed species, lamb's-quarters, mustard species, wild buckwheat, green and yellow foxtail.

Uptake and Translocation: Desmedipham/phenmedipham is readily absorbed by foliage where it inhibits photosynthesis in the chloroplasts of leaf cells.

Basis of Selectivity: Rapid metabolism in tolerant species.

Application Methods: Postemergence beginning at the 2 true-leaf stage of sugar beets. Up to the 2 or 4 leaf stage of weeds depending upon species. Best control is exhibited on very small, actively growing weeds. Apply to red garden beets before the beets reach the 4 leaf stage.

Residual Activity: Soil half-life of desmedipham is less than 1 month and of phenmedipham is 25–30 days.

Unique Characteristics: Desmedipham/phenmedipham may cause temporary growth retardation and/or chlorosis or tip-burn to sugar beets when applied to stressed plants. Normal growth is resumed in 10 days after application.

DICAMBA

Trade Names: BANVEL II, HAWKEYE™ POWER, ORACLE, VANQUISH, VMD 480. XTENDIMAX WITH VAPORGRIP TECHNOLOGY.

Chemical Family: Benzoic acid.

Crop and/or Non-Crop Registrations: Field corn, spring and winter wheat, spring barley, spring rye, oats, soybeans (Roundup Ready 2 Xtend varieties only - applicable only to BANVEL II and XTENDIMAX brands) summer fallow and stubble, pastures, red fescue, lowbush blueberries and turf; non-crop areas such as roadsides, utility rights-of-way and railways.

Sensitive Weeds: Annual weeds (1.25 L/ha): buckwheat (tartary, wild), cleavers, corn spurry, cow cockle, Canada fleabane, common ragweed, giant ragweed, lady's thumb, lamb's-quarters, mustard spp., pigweed spp., smartweed and velvetleaf. Perennial weeds (1.25 L/ha): field bindweed, sow-thistle (perennial), Canada thistle. Brush weeds (when tank-mixed with 2,4-D): alder, aspen poplar, cherry, western snowberry, wolf willow, prickly rose and wild rose.

Uptake and Translocation: Readily absorbed by roots, stems or leaves and then translocated to other plant parts.

Basis of Selectivity: Metabolism by tolerant species.

Application Methods: Preemergence or postemergence in field corn and soybeans (Roundup Ready 2 Xtend varities only). For all other crops and non-crop uses, apply postemergence.

Residual Activity: Half-life in soil is approximately 30 days. Residue carryover into the next season is not a problem when applied at rates labelled for crop situations.

Unique Characteristics: Spray drift is toxic to sensitive plants in the same manner as 2,4-D, thus similar precautions should be followed. Cold weather conditions and/or subsequent high rainfall after dicamba application may lead to temporary corn injury particularly on early-season hybrids in Eastern Ontario. There is also a possibility of dicamba vapour drift from treated plant foliage during high temperatures (in excess of 25°C). At higher rates, dicamba can be toxic to trees and shrubs having roots under the treated areas.

DICAMBA/ATRAZINE

Trade Name: MARKSMAN.

Chemical Family: Benzoic acid/s-triazine.

Crop and/or Non-Crop Registrations: Field corn.

Sensitive Weeds: Buckwheat (wild, tartary), cleavers, cocklebur (emerged only), corn spurry, cow cockle, field bindweed, green smartweed, lady's thumb, lamb's-quarters, mustards, pigweed (redroot, Russian), ragweed (common and giant), sow-thistle (perennial), Canada thistle, velvetleaf, volunteer adzuki beans, waterhemp.

Application Methods: Preemergence and Postemergence until the standing height of the corn is 13 cm (5 leaf stage).

Unique Characteristics: Provides season long broadleaf weed control in corn. Provides excellent control of triazine-resistant broadleaf weeds and is particularly effective in controlling velvetleaf and other later-germinating deep-rooted annuals.

DICAMBA/MCPA

Trade Name: DYVEL.

Chemical Family: Benzoic acid/phenoxy.

Crop and/or Non-Crop Registrations: Barley, spring wheat, winter wheat and oats.

Unique Characteristics: Provides better control of mustards and hemp-nettle than dicamba alone. Also see notes on DICAMBA and MCPA.

DICAMBA/MCPA/MECOPROP-P

Trade Name: SWORD, TARGET, TRACKER XP.

Chemical Family: Benzoic acid/phenoxy/phenoxy.

Crop and/or Non-Crop Registrations: Spring wheat, barley, oats not underseeded to legumes, stubble fields and summer fallow.

Sensitive Weeds: At field-crop rates: wild buckwheat, cow cockle, lady's-thumb, green smartweed, mustards, hemp-nettle, Russian thistle, corn spurry, flixweed, annual sow-thistle, shepherd's-purse, common ragweed, pigweeds, chickweed, lamb's-quarters, knotweed, volunteer rapeseed and sunflowers.

Application Methods: Postemergence when weed seedlings are in the 2–3 leaf stage, spring wheat and oats are in the 4–5 leaf stage and barley is in the 2–3 leaf stage. Use water carrier and apply at 100 L total spray mix/ha.

Unique Characteristics: This mixture controls a wider spectrum of weeds than any of the herbicide components used alone. Under certain conditions, this mixture may cause shortening of the straw of cereals but yield will not be affected. See also DICAMBA, MECOPROP-P and MCPA.

DICHLOBENIL

Trade Name: CASORON 4G.

Chemical Family: Benzonitrile.

Crop and/or Non-Crop Registrations: Cranberries, fruit trees, grapes, highbush blueberries, raspberries, container nursery stock, woody nursery stock, shelterbelts and non-crop areas.

Sensitive Weeds: Most weeds are susceptible to or suppressed by, dichlobenil including perennials, vetch and horsetail.

Uptake and Translocation: Absorbed by the roots and rapidly translocated upward in the plant.

Basis of Selectivity: Selectivity is based on physical separation between the dichlobenil vapour layer in the top 5 cm of soil and the established crop roots below this level.

Application Methods: Apply preemergence to the weeds, preferably in either fall or early spring.

Residual Activity: May persist and provide weed control for 2–6 months; higher rates and applications following use in previous year(s) may result in soil residues persisting for longer than 1 year.

Unique Characteristics: Although applied as a granular herbicide it kills by means of a vapour phase in the top soil profile. Weed roots take up the herbicide as they enter this zone. Do not apply dichlobenil during periods of high soil temperature, since loss of control will result due to volatilization of the herbicide.

DICHLORPROP/2,4-D

Trade Names: DICHLORPROP D, DICHLORPROP DX, ESTAPROP PLUS, ESTAPROP XT, TURBOPROP.

Chemical Family: Phenoxy/phenoxy.

Crop and/or Non-Crop Registrations: Spring and fall wheat and barley; perennial weed and brush control on non-cropland.

Sensitive Weeds: 2.75 L/ha – annual sow-thistle, bluebur, burdock, common ragweed, Canada thistle, cocklebur, curled dock, dandelion, dog mustard, flixweed, giant ragweed, kochia, lady's thumb, lamb's-quarters, night-flowering catchfly, oak-leaved goosefoot, perennial sow-thistle, prickly lettuce, mustard spp., pigweed (redroot, Russian), round leaved mallow, Russian thistle, shepherd's-purse, smartweed spp., spreading atriplex, stinkweed, stork's-bill, volunteer canola, volunteer sunflower and wild buckwheat.

Unique Characteristics: Most properties of dichlorprop are very similar to those of 2,4-D. Do not use on oats. See also 2,4-D, page 40.

DIFLUFENZOPYR/DICAMBA

Trade Name: DISTINCT.

Chemical Family: Semicarbazone/Benzoic acid.

Crop and/or Non-Crop Registrations: Field corn (silage and grain).

Sensitive Weeds: Redroot pigweed, common ragweed, lamb's-quarters, wild buckwheat, lady's-thumb, Canada thistle, cocklebur (emerged), waterhemp (tall) and , velvetleaf. Controls horsenettle and horsetail when tank-mixed with nicosulfuron/rimsulfuron. Control is best when weeds are actively growing.

Uptake and Translocation: Readily absorbed by roots, stems or leaves and then translocated to other plant parts.

Basis of Selectivity: Metabolism by tolerant species.

Application Methods: Apply postemergence from the 2 to 6 leaf stage of corn.

Residual Activity: Half-life in soil is approximately 30 days. Residue carryover into the next season is not a problem when applied at registered rates.

Unique Characteristics: This product has a wider application window, a lower use rate and has better activity on perennial weeds than dicamba alone. Spray drift is toxic to sensitive plants in the same manner as 2,4-D, thus similar precautions should be followed. The auxin transport inhibitor, diflufenzopyr, will also be active with other growth hormone herbicides such as 2,4-D and clopyralid and may cause crop injury if tank-mixed. Do not use additives such as oils, ionic surfactants, wetting agents, sticking agents, etc. Do not apply when there is a risk of severe drop in night temperature. Do not spray when temperatures are expected to exceed 27°C. Do not spray in high humidity or fog. Do not apply preemergence on sandy or sandy loam soils. Do not till or cultivate treated area for at least 7 days following application. Adding a non-ionic surfactant at 0.25% v/v plus liquid nitrogen fertilizer 28-0-0 at 1.25% is suggested for postemergence applications.

DIMETHENAMID-P

Trade Name: FRONTIER MAX, OUTLOOK.

Chemical Family: Chloroacetamide.

Crop and/or Non-Crop Registrations: Corn (field, seed and sweet), dry beans (kidney, otebo and white), peanuts, soybeans, cabbage (transplanted), dry bulb onions, green onions, ornamentals (field and container grown), non-bearing grape vines and potatoes.

Sensitive Weeds: Green and yellow foxtail, barnyard grass, fall panicum, witchgrass, large and smooth crabgrass, redroot pigweed, eastern black nightshade, and tall waterhemp. Yellow nutsedge can be controlled with a preplant incorporated application.

Uptake and Translocation: Absorbed through shoots and roots of germinating grass and broadleaf weeds but primarily via plant coleoptile.

Basis of Selectivity: Not established.

Application Method: 1) preplant incorporated – incorporate with vibrating shank cultivator, harrow or other implement capable of giving uniform shallow incorporation into the top 5 cm of the soil within 7 days of planting; 2) preemergence – rainfall is needed within 10 days of application to achieve sufficient herbicide activation; 3) early postemergence (corn only) – apply at the spike to 3 leaf stage of corn and up to the 2 leaf stage of annual grass weeds.

Residual Activity: Provides season-long weed control. Length of residual activity depends upon soil and moisture factors, application rate and timing. Heavy rainfall following an incorporated treatment may reduce weed control.

Unique Characteristics: No recropping restrictions in the fall or spring application in corn or soybeans. Application flexibility; there are many tank-mix and sequential treatment options for broad-spectrum weed control in corn and soybeans in all tillage systems (zero tillage to conventional tillage). Mixes well with bulk liquid and dry fertilizers.

DIQUAT

Trade Name: DIQUASH, REGLONE DESICCANT.

Chemical Family: Bipyridylium.

Crop and/or Non-Crop Registrations: Desiccation of canola, flax, dry beans, dry peas, mustard, sunflowers, soybeans, adzuki beans, legume seed crops. Vine killing of potatoes. Control of corn spurry in oats. Stale seedbed and inter-row weeding.

Sensitive Weeds: Any foliage contacted by diquat will be killed.

Uptake and Translocation: Rapidly absorbed by foliage. Limited translocation.

Basis of Selectivity: None.

Application Methods: Postemergence.

Residual Activity: Essentially none due to adsorption of chemical to soil particles.

Unique Characteristics: Must be used with clean (non-turbid) water as the soil particles in muddy water drastically reduce the effectiveness of diquat. Apply in weather conditions that will not promote drift. For aerial application suggested conditions for good application are moderate temperatures (less than 25°C), humidity (greater than 40%) and wind (3.6–10 km/h). Do not apply in dead calm conditions or when temperature inversion is likely (e.g., morning or evening when warm air is rising from crop). To avoid spray drift, use flat fan or hollow cone nozzles and a pressure of 140–210 kPa. For aerial application point the nozzles back 130°–180°. For further information on aerial application see product label.

DIQUAT (AQUATIC)

Trade Name: REWARD.

Chemical Family: Bipyridylium.

Crop and/or Non-Crop Registrations: Aquatic weed control in still or flowing water in ponds, ditches, lakes and canals.

Sensitive Weeds: Coontail, Canada Waterweed, pondweeds, milfoil and duckweed.

Uptake and Translocation: Contact desiccant with limited translocation.

Basis of Selectivity: None.

Application Methods: Postemergence. Apply when weeds are visible and are actively growing. It can be applied: with a boat bailer device that injects the chemical below the water surface; sprayed over the water surface; or poured directly from a container onto the surface.

Residual Activity: Quickly inactivated by adsorption to soil particles.

Unique Characteristics: Must be used with and applied on non-turbid water, as the soil particles in muddy water drastically reduce the effectiveness of the material. Do not use treated water for swimming or consumption by humans or animals for at least 24 hours. Do not use water for irrigation for 5 days after treatment. To avoid fish kills caused by oxygen depletion, treat only ¼–⅓ of the area at a time. Avoid application or drift onto crops, lawns, grazing areas, ornamental plants and other desirable plants.

DITHIOPYR

Trade Name: DIMENSION.

Chemical Family: Pyridine.

Crop and/or Non-Crop Registrations: Turf.

Sensitive Weeds: Crabgrass.

Uptake and Translocation: Absorbed through the shoots and roots. Limited translocation.

Basis of Selectivity: Differential uptake, translocation and metabolism in sensitive seedling weeds vs. established plants.

Application Methods: Preemergence or early postemergence up to the 3 leaf stage of crabgrass.

Residual Activity: Effective weed control may be maintained for 3 months.

Unique Characteristics: Preemergence and early postemergence activity allows control of emerged plants and follow-up residual control of later germinating crabgrass plants.

DIURON

Trade Name: KARMEX, DIUREX 80WDG.

Chemical Family: Substituted urea.

Crop and/or Non-Crop Registrations: Grapes, asparagus, gladioli, industrial sites, right-of-ways.

Sensitive Weeds: Annual and perennial grasses, pigweed, ragweed, wild carrot and dandelion. Perennial weed control at higher rates in non-crop areas.

Uptake and Translocation: Most readily absorbed by roots, less so by foliage. Translocated upward in the xylem.

Basis of Selectivity: Used only in deep-rooted crops that are well established.

Application Methods: Applied to crops as a preemergence or directed early postemergence spray, preferably before weed growth becomes dense. Better control of emerged weeds is obtained by the addition of a suitable surfactant. In non-crop areas, diuron may be sprayed anytime except when ground is frozen.

Residual Activity: At lower rates used in crops, residues last about a year and thus applications may be repeated annually. At higher non-crop rates, persistence may be more than 1 year.

Unique Characteristics: Do not use where it is likely to leach or wash into contact with the roots of desirable trees or shrubs.

EPTC

Trade Name: EPTAM.

Chemical Family: Thiocarbamate.

Crop and/or Non-Crop Registrations: Alfalfa, bird's-foot trefoil, flax, potatoes, sunflowers, sugar beets, turnips, and annual flowers. EPTAM is registered for use dry on a number of different edible bean market classes, refer to Table 7–1. *Beans (Adzuki, Dry, Lima and Snap) Weed Control Ratings,* page 101 for specific crop registrations.

Sensitive Weeds: Annual grasses such as crabgrass, barnyard grass, fall panicum, wild oats, green foxtail and yellow foxtail, yellow nutsedge, some annual broadleaf weeds such as corn spurry, lamb's-quarters, nightshade, pigweed and chickweed if conditions are favourable for germination and growth.

Uptake and Translocation: Uptake by underground plant parts (roots, hypocotyl and seed). Upward translocation to the growing tip.

Basis of Selectivity: Metabolized by tolerant species at the seed germination stage through enzymatic breakdown of the chemical. Seed food reserves also permit seedling to outgrow chemical effect.

Application Methods: Preplant incorporated or postplant incorporated. May be applied using water or liquid fertilizers as the carrier. Dry fertilizers may also be used as a carrier when impregnated by licenced fertilizer dealers. To prevent chemical loss and reduced weed control, EPTC should be uniformly incorporated in the soil by setting the incorporation equipment (i.e., tandem disks, field cultivator with sweep teeth, or vibrating shank S-tine cultivator) to work the soil approximately 10 cm deep, followed by a levelling device. Irrigation (approximately 0.6 cm) can also be used to incorporate. When application and incorporation are done in separate operations, application should be on a dry soil surface.

Residual Activity: Applied in the spring preplant, EPTC provides season-long weed control with no soil residues the following year to prevent crop rotation.

Unique Characteristics: EPTC does not need rainfall to activate and will not leach significantly under heavy rainfall. Under unfavourable germination conditions, leaf crinkling or leaf sealing may be observed on certain crops but usually without adverse effects on yield. May be tank-mixed with metribuzin for additional broadleaf weed control in potatoes. May be tank-mixed with ethalfluralin or trifluralin for additional broadleaf weed control in beans (white, snap and kidney). See label for other tank-mix combinations and information on less conventional application methods.

ETHAMETSULFURON-METHYL

Trade Name: MUSTER.

Chemical Family: Sulfonyl urea.

Crop and/or Non-Crop Registrations: Spring canola, rutabagas.

Sensitive Weeds: Wild mustard.

Uptake and Translocation: Following foliar application, is rapidly absorbed and translocated in both xylem and phloem.

Basis of Selectivity: Inhibition of acetolactate synthase in susceptible plants leads to a rapid cessation of cell division and growth. Tolerant species rapidly convert etha-metsulfuron-methyl to non-phytotoxic metabolites.

Application Methods: Postemergence.

Residual Activity: Rapid soil microbial degradation.

Unique Characteristics: A non-ionic surfactant must be added. Typical symptoms of plant death (leaf crinkling, curling, chlorosis) occur 5–10 days after application depending on growing conditions.

ETHOFUMESATE

Trade Name: NORTRON.

Crop and/or Non-Crop Registrations: Sugar beets.

Sensitive Weeds: Chickweed, lamb's-quarters, kochia, redroot pigweed, Russian thistle, wild buckwheat, barnyard grass, large crabgrass, foxtails and downy brome.

Uptake and Translocation: Readily absorbed by emerging shoots (grass coleoptile and broadleaf hypocotyl) and roots, and translocated readily to the foliage. Postemergence applications of ethofumesate are poorly absorbed by maturing leaves with a well-developed cuticle.

Basis of Selectivity: Tolerant species conjugate the herbicide, rendering it inactive.

Application Methods: Preplant incorporated, preemergence.

Residual Activity: Half-life of less than 5 to more than 14 weeks depending on soil temperature and moisture conditions. Half-life increases in cooler, drier soils.

FEHEDTA (IRON)

Trade Name: FIESTA LAWN WEED KILLER.

Crop and/or Non-Crop Registrations: Lawns and turf, non-crop areas.

Sensitive Weeds: dandelion, English daisy, false dandelion, white clover, black medic, bull thistle, Canada thistle, common chickweed, creeping buttercup, slender speedwell, narrow-leaved plantain, dove's-foot geranium, lawn burweed, moss, algae and boradleaved plantain (suppression).

FENOXAPROP-P-ETHYL

Trade Name: EXCEL SUPER, ACCLAIM SUPER.

Chemical Family: Aryloxyphenoxypropionate.

Crop and/or Non-Crop Registrations: EXCEL SUPER – Asparagus, broccoli, cabbage, cauliflower, carrots, dry bulb onions, peas (field and processing), potatoes, canola, triazine-tolerant canola, soybeans, tomatoes. EXCEL SUPER is registered for use on a number of different edible bean market classes, refer to Table 7–1. *Beans (Adzuki, Dry, Lima and Snap) Weed Control Ratings,* page 101 for specific crop registrations. ACCLAIM SUPER – Lawns and turf.

Sensitive Weeds: Barnyard grass, green and yellow foxtail, crabgrass, witchgrass, wild proso millet, fall panicum, volunteer corn.

Uptake and Translocation: Uptake primarily through the leaves. Does not translocate significantly.

Basis of Selectivity: Differential metabolism by tolerant vs. sensitive species.

Application Methods: Non-residual postemergence for the control of annual grasses (EXCEL SUPER – 1–6 leaf stage; ACCLAIM SUPER – 1–4 leaf stage plus 3 tillers). For best results, apply when weeds are young and actively growing. EXCEL SUPER – Do not apply if rainfall is expected within 1 hour of application. ACCLAIM SUPER – Do not apply if rainfall is expected within 3 hours of application.

Residual Activity: Essentially none.

Unique Characteristics: EXCEL can be tank-mixed with BASAGRAN FORTÉ and/or PINNACLE for broad-spectrum annual weed control in soybeans and dry beans only. If annual grasses are in the correct stage for application before broadleaf weeds have emerged, do not delay EXCEL SUPER application.

FENOXAPROP-P-ETHYL/SAFENER

Trade Name: BENGAL, PUMA ADVANCE, VIGIL.

Chemical Family: Aryloxyphenoxypropionate.

Crop and/or Non-Crop Registrations: Spring wheat, spring barley (PUMA ADVANCE only).

Sensitive Weeds: Wild oats, foxtail (green, yellow) and barnyard grass.

Basis of Selectivity: Metabolism by tolerant species.

Application Methods: Postemergence, apply to wild oats at the 1–6 leaf stage (plus 3 tillers) and prior to flag leaf emergence of spring wheat. For best results, apply when weeds are young and actively growing.

Residual Activity: Essentially none.

Unique Characteristics: PUMA ADVANCE can be tankmixed with BUCTRIL M for broad-spectrum annual broadleaf weed control in spring wheat. Treatment at the 3–4 leaf stage of crops and weeds usually combines maximum crop tolerance and weed susceptibility. Under stressed conditions and/or heavy crop canopy, earlier application will result in improved grassy weed control. PUMA ADVANCE contains a safener which allows spring cereals to metabolize fenoxaprop-p-ethyl. Spraying with a fenoxaprop-p-ethyl product not containing this safener (i.e. EXCEL SUPER) will result in severe crop injury.

FLUAZIFOP-P-BUTYL

Trade Names: VENTURE L.

Chemical Family: Aryloxyphenoxypropionate.

Crop and/or Non-Crop Registrations: Flax, canola, soybeans, sugar beets, sunflowers, tobacco, forage legumes (alfalfa, red clover and bird's-foot trefoil), asparagus, cabbage, broccoli, Brussels sprouts, cauliflower, cucumber, ginseng, onions, peanut, potatoes, rutabagas, lupins, tomatoes, lowbush and highbush blueberries, raspberries, strawberries, non-grassy ornamental plants, poplars, shrubs, trees, apples, apricots, cherries, cranberries, grapes, peaches, pears and plums, forest and ornamental nurseries.

Sensitive Weeds: Barnyard grass, crabgrass, fall panicum, foxtail (giant, green, yellow), Johnson grass, volunteer corn, wheat and barley, wild oats, wirestem muhly, witchgrass, and quackgrass.

Uptake and Translocation: Absorbed primarily by leaves. Translocated to roots and rhizomes.

Basis of Selectivity: Metabolism by tolerant species.

Application Methods: Postemergence. Apply when grasses are actively growing, and annual grasses are in the 2–5 leaf stage and quackgrass is in the 3–5 leaf stage.

Residual Activity: Essentially none.

Unique Characteristics: Preplant tillage to break up rhizomes will improve control of quackgrass. Except as noted on the label, apply broadleaf herbicides separately at least 3 days after fluazifop-p-butyl. Do not cultivate for 5 days after applying fluazifop-p-butyl. When plants are stressed (lack of moisture, excessive humidity, low temperature and/or very low relative humidity), fluazifop-p-butyl is less effective. Regrowth by tillering may occur if application is made under any of the above conditions. Since there is no residual activity, a new flush of weeds may emerge after the first flush has been controlled.

FLUMETSULAM

Trade Name: BROADSTRIKE RC.

Chemical Family: Triazolopyrimidine sulfonanilide.

Crop and/or Non-Crop Registrations: Soybeans.

Sensitive Weeds: Common lamb's-quarters, redroot pigweed, eastern black nightshade, and velvetleaf are controlled. Cocklebur, green foxtail, and lady'sthumb are suppressed.

Uptake and Translocation: Flumetsulam is absorbed by both roots and shoots of germinating broadleaf weeds.

Basis of Selectivity: Selectivity of flumetsulam in soybeans is based on metabolism.

Application Methods: Surface preplant, preplant incorporated or preemergence.

Residual Activity: The most significant means of dissipation of flumetsulam is microbial degradation. Provides season-long residual control of annual broadleaf and grass weeds. Rotational crops are winter wheat, spring wheat, spring barley, soybeans, common beans (dry, snap), lima beans, peas, field corn, seed corn.

Unique Characteristics: Can be applied up to 21 days before planting. Rainfall within 7–10 days is required for maximum activity of a preemergence application. Do not apply to areas where the soil pH is more than 7.8 and organic matter is less than 2%. Do not apply to soils containing more than 5% organic matter. Suspension concentrate formulation separates into 2 phases over time. Shake container well before using.

FLUMIOXAZIN

Trade Name: BROADSTAR, CHATEAU, PAYLOAD, SUREGUARD, VALTERA.

Chemical Family: Dicarboxamide.

Crop and/or Non-Crop Registrations: Celery, dry bulb onion, potato, pome fruit (apple and pear), grape, strawberry, highbush blueberry, stone fruit (peach, cherry, nectarine, plum and apricot), asparagus, field-grown woody ornamentals, peppermint, soybeans, spearmint, tree nuts, edible bean dessicant and non-crop areas.

Sensitive Weeds: Hairy bittercress, liverwort, pigweed spp., common ragweed, lamb's-quarters, hairy nightshade, eastern black nightshade. Suppression of green foxtail, common groundsel and common chickweed.

Uptake and Translocation: Primarily taken up by the roots of treated plants following soil applications. Movement in the phloem is limited because of the rapid foliar desiccation caused by the herbicide.

Application Methods: See label for specific timing in each registered crop. In general, flumioxazin must be applied prior to weed emergence.

Residual Activity: Generally will provide 4–6 weeks of broadleaf weed control, however the length of residual control is dependent on application rate, rainfall and temperature conditions following application.

Unique Characteristics: Flumioxazin is a soil applied herbicide providing residual control of annual broadleaf weeds and suppression of grassy weeds. Moisture is necessary for effective residual weed control. Dry weather following applications of flumioxazin may reduce effectiveness. Flumioxazin will not control emerged weeds and may not control weeds that germinate after application but before an activating rainfall or weeds that germinate through cracks resulting from dry soil. Disturbing soil surfaces may reduce efficacy.

FLUMIOXAZIN + METRIBUZIN

Trade Name: PERFECTA (co-pack of VALTERA and TRICOR).

Chemical Family: Dicarboxamide. S-triazine.

Crop and/or Non-Crop Registrations: Soybeans

Application Methods: Apply pre-plant or pre-emergence but no longer than 3 days after planting.

For all other information: Refer to flumioxazin and metribuzin alone.

FLUMIOXAZIN + METRIBUZIN + IMAZETHAPYR

Trade Name: TRIACTOR (co-pack of VALTERA, TRICOR and NU-IMAGE).

Chemical Family: Dicarboxamide. S-triazine, Imidazolinone.

Crop and/or Non-Crop Registrations: Soybeans

Application Methods: Apply pre-plant or pre-emergence but no longer than 3 days after planting.

For all other information: Refer to flumioxazin, metribuzin and imazethapyr alone.

FLUMIOXAZIN/PYROXASULFONE

Trade Name: FIERCE.

Chemical Family: Dicarboxamide and Isoxazoline/Aryl triazolinone.

Crop Registrations: Soybeans.

Sensitive Weeds: lamb's-quarters, Common ragweed, Common Waterhemp, Dandelion, Eastern black nightshade, Green foxtail, Green pigweed, Hairy nightshade, Large crabgrass, Palmer amaranth,Pennsylvania smartweed, Redroot pigweed, Velvetleaf, Wild buckwheat, Wild mustard, Kochia, Canada fleabane

Basis of Selectivity: Metabolized by tolerant species.

Application Methods: Early preplant and preemergence. Rainfall within 10 days is required for maximum activity of the preemergent application.

Residual Activity: Provides season long control of labeled weeds and is dependent on soil type, moisture and rate of application.

Unique Characteristics: The rate of application depends on weed pressure. Lack of moisture or too much moisture can affect activity. Winter cereals may be planted 4 months after application.

FLUROXYPYR

Trade Name: TROPHY A.

Chemical Family: Pyridine.

Crop and/or Non-Crop Registrations: Winter wheat.

Sensitive Weeds: Cleavers, kochia, round-leaved mallow, volunteer flax. Suppression of chickweed, hempnettle, stork's bill and wild buckwheat.

Application Methods: Postemergence from the 3 leaf to flag leaf stage of winter wheat.

Residual Activity: Half life ranges from 11–38 days. Fluroxypyr provides very little residual weed control.

Unique Characteristics: This product was specifically brought to the Ontario marketplace for the control of cleavers in winter wheat. Trophy A is one component of the Trophy co-pack, the second component is Trophy B (MCPA). Field experience has shown that it also provides suppression of tufted vetch, an increasingly problematic species in Ontario.

FOMESAFEN

Trade Name: REFLEX.

Chemical Family: Diphenyl ether.

Crop Registrations: Cucumber, soybeans, and is registered for use on a number of different edible bean market classes, refer to Table 7–1. *Beans (Adzuki, Dry, Lima and Snap) Weed Control Ratings*, page 101 for specific crop registrations.

Sensitive Weeds: Redroot pigweed, common ragweed, wild mustard, lady's-thumb, eastern black nightshade, cocklebur; suppression of velvetleaf, lamb's-quarters, tall waterhemp.

Uptake and Translocation: Taken up through foliage. Not readily translocated.

Mode of Action: Cell-membrane disrupter.

Method of Selectivity: Beans metabolize fomesafen. Some initial bronzing of crop leaves may occur, but plants normally outgrow this condition without any effect on maturity or yield.

Application Method: Early postemergence to weeds and crop. Apply when beans are 1–2 trifoliate and weeds are at the 2–4 leaf stage. Good coverage is essential for optimum weed control. Apply in 200–350 L of water/ha at a pressure between 245–420 kPa. Always add an adjuvant such as AGRAL 90 (0.25% v/v) or TURBOCHARGE (0.5% v/v). PINNACLE or VENTURE may be tank-mixed for additional weed control.

Residual Activity: Persistence depends on weather and soil conditions (more persistent under dry conditions). Rotation to field corn, dry beans or soybeans the following year. Winter wheat may be planted 90 days after treatment. All other crops require a field bioassay.

Unique Characteristics: Do not apply REFLEX to any field more than once every 2 years.

FORAMSULFURON

Trade Name: OPTION 2.25 OD.

Chemical Family: Sulfonylurea.

Crop and/or Non-Crop Registrations: Field Corn, lowbush blueberries.

Sensitive Weeds: Quackgrass, green, yellow and bristly foxtail, fall panicum, proso millet, barnyard grass, witchgrass, large crabgrass, redroot pigweed, common lamb's-quarters, velvetleaf, eastern black nightshade, common chickweed, wild and wormseed mustard.

Uptake and Translocation: Foramsulfuron is quickly absorbed through leaves and rapidly translocated throughout the plant.

Basis of Selectivity: Inhibition of acetolactate synthase (ALS) enzyme in susceptible plants. Tolerant species rapidly metabolize foramsulfuron.

Application Methods: Postemergent from the 1–8 leaf stage of corn, emerged grassy weeds up to the early tillering stage, emerged broadleaf weeds.

Residual Activity: Essentially none.

Unique Characteristics: Addition of the safener isoxadifen in the formulated product maximizes crop tolerance, enhances crop recovery under severe environmental conditions and allows the use of an ethylated/methylated seed oil based adjuvant system.

FUMIGANTS

See METAM SODIUM, page 60.

GLUFOSINATE AMMONIUM

Trade Name: IGNITE, LIBERTY 200SN.

Chemical Family: Unique.

Crop and/or Non-Crop Registrations: IGNITE – Desiccation of dry beans; directed applications in apples, apricots, highbush blueberries, sweet and sour cherries, grapes, nectarines, peaches, pears and plums, raspberries and tree nuts; stale seedbed techniques in asparagus, carrots, lettuce and onions; ground crack application in potatoes. LIBERTY 200SN – Corn hybrids, soybean and canola varieties specially developed to be tolerant to Liberty 200SN herbicide. Glufosinate-ammonium tolerant inbred lines grown for seed corn production.

Sensitive Weeds: Non-selective – affects all actively growing green plants; regrowth of perennial species may occur.

Uptake and Translocation: Absorbed through foliage; minimal translocation – dependent on application rate and species treated.

Basis of Selectivity: IGNITE – All green plant tissue is sensitive; safe on mature (non-green) bark of woody plants. LIBERTY 200SN – All green plant tissue is sensitive except for field corn, seed corn, soybeans and canola plants that have been specially developed to be tolerant.

Application Methods: IGNITE – Postemergence; broadcast or directed spray to avoid contact with leaves or green bark of desirable plants; thorough coverage of the plant tissue to be controlled is essential. LIBERTY 200SN – Postemergence. Can be broadcast in "Liberty Link" corn at the 1–8 leaf stage, apply with drop nozzles to later corn growth stages; cotyledon to flowering stage in "Liberty Link" soybeans and cotyledon to early bolting stage in InVigor canola.

Residual Activity: None; there are no cropping or rotational restrictions after application.

Unique Characteristics: Speed of action is influenced by environmental factors; at cool temperatures, poor moisture and low humidity, speed of action may be reduced. Heavy dew at time of application may reduce control of certain weed species.

GLYPHOSATE

Trade Names: CREDIT XTREME EZJECT, FACTOR, FACTOR 540 FORTRAN GLYPHOSATE, FORZA SILVICULTURAL HERBICIDE, GLYFOS, MATRIX, MAVERICK III, POLARIS, RIVET, ROUND-UP ULTRA 2, ROUNDUP WEATHERMAX, SHARPSHOOTER, SHARPSHOOTER PLUS, TOUCHDOWN TOTAL, TRAXION, VANTAGE PLUS MAX II, VISION MAX SILVICULTURE, VANTAGE XRT.

Chemical Family: Amino acid.

Crop and/or Non-Crop Registrations: Preplant or postharvest with no cropping restrictions. Preharvest in wheat, barley, soybeans, canola, flax, lentils, peas and forages. "Roundup Ready" Crops – refer to Table 4–3. *Glyphosate Products, Registered Uses and Rates Needed to Control Specific Weed Species in Glyphosate Tolerant Crops*, page 72. Directed applications in ginseng, cherries, grapes, apples, pears, plums and peaches, strawberries as wiper or spot treatment. Non-crop registrations: Brush control; turf renovation; chemical mowing; directed application in woody nursery stock, roadsides and shelterbelts. E-Z-JECT – Selective woody brush and tree control, forest tree plantings, forest tree nurseries and tree nuts.

Sensitive Weeds: Annual grasses; perennial weeds (quackgrass, Canada thistle, sow-thistle, field bindweed, milkweed, cattails, nutsedge, poison-ivy etc.); brush (birch, alder, poplar, raspberry, willow and maple).

Uptake and Translocation: Absorbed through foliage and translocated throughout the plant.

Basis of Selectivity: Non-selective for agricultural crops. Conifers are tolerant at some stages but the basis has not been established.

Application Methods: Postemergence, usually at the bud to bloom stage of growth for most perennial weeds. Canada thistle should be at least in early flower bud, milkweed at flower bud and bindweed at full flower. Quackgrass can be treated in the spring or fall when it is actively growing with at least 3–4 new leaves on each emerged shoot; in the fall, remove crop refuse but do not till prior to application; fall or spring tillage prior to spring application may reduce control; wait at least 3–5 days after application before working the area; for maximum control it is advisable to till before the quackgrass turns completely brown. Glyphosate can be applied with boom equipment, knapsack sprayers and high-volume equipment for agricultural and non-crop uses. Backpack mist blowers may be used for silvicultural site preparation and roadside brush control only. Aerial applications may be used for silvicultural site preparation and conifer release only. Can also be applied with selective equipment for non-crop areas, tree plantings, grapes and orchards (See *Preplant Weed Control*, page 95 and *Wick Wiper and Roller Application*, page 100). Regardless of method of application, do not allow herbicide solution to contact green foliage or green bark of crop or other desirable plants; remove all suckers from the trunks of desirable trees before spraying.

Residual Activity: None – crops can be planted or seeded directly into treated areas following application. Other herbicides are required to control weeds emerging after the application.

Unique Characteristics: Rainfall within 6 hours after application or heavy frost within 24 hours may reduce control for 356 g/L formulations. 360 g/L formulations are rainfast as soon as 4 hours after application. ROUNDUP ULTRA 2, ROUNDUP WEATHERMAX, FACTOR 540 and TOUCHDOWN TOTAL are rainfast as soon as 1 hour after application.

GLYPHOSATE/FOMESAFEN

Trade Name: FLEXSTAR GT.

Chemical Family: Amino acid/Diphenyl ether.

Crop Registrations: Soybeans.

Sensitive Weeds: All weed species listed on glyphosate labels at comparable use rates in addition to residual control of common ragweed and redroot pigweed.

Uptake and Translocation: Absorbed through the foliage of emerged plants. Glyphosate component is readily translocated throughout the plant while the fomesafen component is not readily translocated. Selected broadleaf residual weed control provided by shoot uptake.

Basis of Selectivity: Metabolized by glyphosate tolerant soybean species when applied postemergence. Some initial bronzing of crop leaves may occur after postemergence application, but plants normally outgrow this condition without any effect of maturity or yield. When applied surface preplant or preemergence, the soybeans safely metabolize the fomesafen component.

Application Methods: Surface preplant (up to 7 days prior to planting) and preemergence across all types of soybeans. Postemergence: from the 1–2 trifoliate stage of only glyphosate tolerant soybeans.

Residual Activity: 3–4 weeks residual activity (control) of redroot pigweed and common ragweed. Winter wheat may be planted 4 months after application.

Unique Characteristics: Do not apply FLEXSTAR GT to any field more than once every 2 years. Add Turbocharge if weeds are stressed (hardened off from drought) or are at the maximum leaf stage specified on the product label.

GLYPHOSATE/MESOTRIONE/ S-METOLACHLOR/BENOXACOR

Trade Name: HALEX GT.

Chemical Family: Amino acid, triketone and acetanalide.

Crop and/or Non-Crop Registrations: Glyphosate tolerant ("Roundup Ready") corn only.

Sensitive Weeds: Emerged annual grass and broadleaf weeds controlled by glyphosate and residual control of unemerged annual grass and broadleaf weeds (see residual activity for specific species).

Uptake and Translocation: Refer to glyphosate, meostrione and s-metolachlor/benoxacor.

Basis of Selectivity: Refer to glyphosate, meostrione and s-metolachlor/benoxacor.

Application Methods: Postemergence from the spike to 6 leaf stage of glyphosate tolerant corn.

Residual Activity: HALEX GT will provide residual control of eastern black nightshade, lady's thumb, lamb's-quarters, pigweed spp. mustard (wild), velvetelaf, barnyardgrass, crabgrass (smooth and large), fall panicum, foxtails (green, yellow and giant), witchgrass.

HALAUXIFEN/FLUROXYPYR

Trade Name: Pixxaro A.

Chemical Family: Synthetic auxins (Picolinic and Carboxylic acids).

Crop and/or Non-Crop Registrations: spring barley, spring wheat, winter wheat.

Sensitive Weeds: postemergent control of alfalfa (volunteer), chickweed, cleavers, flixweed, hemp-nettle, kochia, lamb's-quarters, redroot pigweed, ragweed (common), round-leaved mallow, shepherd's-purse and wild buckwheat.

Basis of Selectivity: Metabolized by tolerant species.

Application Methods: Postemergent from 3 leaf to just prior to flag leaf emergence of barley and wheat.

Residual Activity: Does not provide significant residual weed control.

Unique Characteristics: 1 hour rainfast. Sold only in a co-pack called PIXXARO which contains PIXXARO A and MCPA ESTER 600.

HALOSULFURON

Trade Name: Permit, Sandea.

Chemical Family: Sulfonylurea.

Crop and/or Non-Crop Registrations: Permit- Dry Beans, Field corn (including seed), Sweet Corn, Popcorn, Grain Sorghum. Sandea – includes apples, highbush blueberries, cucumbers, melons, tomatoes, asparagus, snapbeans, squash and other crops, refer to label for crop listing.

Sensitive Weeds: Canada fleabane, Chickweed (common), Cocklebur, Common groundsel, Corn spurry, Creeping yellowcress, Flower-of-an-hour, Fringed (Northern) willowherb, Hairy galinsoga, Horsetail, Jimsonweed, Lamb's-quarters, Plantain, broadleaf, Prickly lettuce, Ragweed (common and giant), Redroot pigweed, Round-leaved mallow, Shepherd's-purse, Smartweed (Lady's-thumb, Pennsylvania), Smooth pigweed, Spiny amaranth, Stinking chamomile, Velvetleaf, Wild mustard, Wild radish and Yellow nutsedge. For certain weeds, activity may be greater as a pre or post emergent treatment. Will not control Group 2 resistant weed populations. Refer to label for application timing and use rate for specific weed control recommendations.

Basis of Selectivity: Metabolized by tolerant species.

Application Methods: Soil applications (Preplant incorporated and preemergent) and postemergent foliar application timings. Refer to label for specific crop staging recommendations.

Residual Activity: Generally will provide 4–6 weeks of control. Length of residual control is dependent on soil and moisture factors, application rate and timing. Refer to label for rotation crop guidelines.

Unique Characteristics: Heavy infestations of nutsedge may require sequential applications. An earlier treatment may be required to prevent nutsedge from competing with the crop. Refer to label for other weeds suppressed. Refer to label for specific crop directions for pre-emergent rates. Refer to label for rotation crop guidelines.

HEXAZINONE

Trade Names: PRONONE, VELPAR.

Chemical Family: Triazine.

Crop and/or Non-Crop Registrations: Christmas trees, coniferous reforestation, non-cropland.

Sensitive Weeds: Most herbaceous broadleaf weeds and grasses including raspberry, bluejoint grass, goldenrod and brome grass; spot applications control aspen, ash, maple, cherry and birch.

Uptake and Translocation: Absorbed through roots and foliage; translocation is primarily upwards through xylem.

Basis of Selectivity: Tolerant species metabolize hexazinone faster than sensitive species. For conifers, at least part of the selectivity is due to the tree roots being deeper than hexazinone leaches into the soil.

Application Methods: For broadcast applications, apply preemergence or as a postemergence foliar spray during active plant growth. For spot applications, use an exact-delivery hand gun applicator to apply undiluted VELPAR as close as possible to the root collar of plants to be controlled; keep spots at least 1 m away from desirable conifers. Apply PRONONE with an approved granular applicator.

Residual Activity: Half-life of 2 months on a Flanagan silt loam in Illinois. Half-life of 2½ months on a silty clay in Northern Ontario.

Unique Characteristics: Rainfall is needed to activate hexazinone in the soil. Do not use on sandy, gravelly or rocky soils, or on frozen ground. Do not apply on steep slopes. Do not apply to areas where the roots of desirable trees may extend. Liquid formulation is flammable. A bioassay may be used to determine soil residue levels when sensitive crops are to be planted in soil treated with hexazinone.

IMAZAPYR

Trade Name: ARSENAL.

Chemical Family: Imidazolinone.

Crop and/or Non-Crop Registrations: Non-crop/non-graze areas such as boreal forests, industrial sites, railroad ballast, spot treatments for rail and highway rights-of-way and pipeline rights-of-way stations including well sites, battery stations and compressor or valve stations.

Sensitive Weeds: Annual and perennial grass and broadleaf weeds such as: annual – black medick, rough cinquefoil, common groundsel, hemp-nettle, kochia, lamb's-quarters, mustard spp., pigweed spp., pineappleweed, ragweed spp., Russian thistle, stinkweed, annual sow-thistle, wild buckwheat, annual bluegrass, foxtail spp., witchgrass; biennial/perennial – bladder campion, bull thistle, burdock, Canada thistle, sulfur cinquefoil, clover spp., dandelion, dog-strangling vine, field bindweed, goat's beard, goldenrod, leafy spurge, milkweed, mouse-eared chickweed, mullein spp., ox-eye daisy, plantain spp., poison-ivy, sheep sorrel, toadflax, tufted vetch, wild carrot, wild grape, wild strawberry, brome grass, Canada bluegrass, fescue spp., quackgrass, yellow nutsedge; seedling woody species – maple, poplar, raspberry and wild rose.

Uptake and Translocation: Absorbed by both roots and foliage of sensitive vegetation. Translocated in both the xylem and phloem.

Basis of Selectivity: None.

Application Methods: Postemergence on actively growing weeds. Control of non-emerged sensitive species will also be provided in the year of application. Apply in 100–550 L of water/ha with high-volume, high-pressure handguns and vehicle-mounted directed-spray equipment or conventional boom-mounted, manifold-mounted or off-centred nozzles. Low-volume, hand-held backpacks, knapsacks or other pump-up-type sprayers may also be used for direct applications to foliage. Add a non-ionic surfactant at 1 L/400 L of spray solution for spray volumes greater than 550 L/ha. A foam-reducing agent may be necessary.

Residual Activity: Season-long control of sensitive species.

Unique Characteristics: Do not contaminate ponds, lakes, streams, wetlands or sloughs and do not apply within 15 m of a wetland area or body of water. Do not mix or store in unlined steel (except stainless steel) containers or spray tanks. For ground application only. Do not use where roots from desirable vegetation may extend into the treated area (maintain a distance from desirable trees equal to at least twice the distance from the trunk to the dripline). To be used by licensed applicators only.

IMAZETHAPYR

Trade Name: CONQUEST B (Available only in CONQUEST LQ co-pack), NU-IMAGE, PHANTOM, PURSUIT.

Chemical Family: Imidazolinone.

Crop and/or Non-Crop Registrations: Soybeans, a number of different edible bean market classes, refer to Table 7–1. *Beans (Adzuki, Dry, Lima and Snap) Weed Control Ratings,* page 101 for specific crop registrations, Clearfield corn, Clearfield canola processing peas, snow peas and alfalfa for seed production.

Sensitive Weeds: Soil applications – green foxtail, yellow foxtail, witchgrass, barnyard grass, lamb's-quarters, redroot pigweed, smartweed, lady's-thumb, wild mustard, velvetleaf, common ragweed and reduced competition from eastern black nightshade and proso millet. Postemergence application – green foxtail, yellow foxtail, witchgrass, barnyard grass, redroot pigweed, velvetleaf, wild mustard, cocklebur, eastern black nightshade, ragweed and reduced competition from proso millet, large crabgrass, lamb's-quarter's, wild buckwheat and yellow nutsedge. Late postemergence application – green and yellow foxtail (up to 4 leaf stage), barnyard grass (up to 6 leaf stage), redroot pigweed (up to 12 leaf stage) and velvetleaf (up to 8 leaf stage), giant ragweed (up to 6 leaf stage).

Uptake and Translocation: Absorbed by both roots and foliage. Translocation in both xylem and phloem.

Basis of Selectivity: Metabolism by tolerant species.

Application Methods: Early preplant (up to 30 days before planting), preplant incorporated, preemergence and postemergence up to the 2 leaf stage of weeds.

Residual Activity: Persistence depends on weather and soil conditions (more persistent under dry conditions). Some rotational restrictions apply, refer to Tables 4–4 and 4–5. *Herbicide Crop Rotation and Soil pH Restrictions,* page 74 and page 76, for more information.

Unique Characteristics: Can be applied up to 30 days prior to planting. Registered for use in reduced and no-till situations. Heavy infestations of ragweed or barnyard grass require a tank-mix with a herbicide that is effective on those species. Postemergence application requires the addition of AGRAL 90, AGSURF or ENHANCE surfactant and liquid fertilizer solution. Temporary soybean discoloration and/or shortening may occur with postemergence applications. A period of 100 days is required between application and planting winter wheat.

IMAZETHAPYR + BENTAZON

Trade Name: CLEANSWEEP (co-pack of PURSUIT + BASAGRAN FORTÉ).

Chemical Family: Imidazolinone+ benzothiadiazine.

Crop and/or Non-Crop Registrations: Soybeans.

Sensitive Weeds: Annual grass (barnyard grass, green and yellow foxtail) and broadleaf (cocklebur, flower-of-an-hour, lady's-thumb, lamb's-quarters, pigweed, ragweed, shepherd's-purse, stinkweed, velvetleaf, wild mustard, eastern black nightshade) species including triazine resistant biotypes and reduced competition from yellow nutsedge, Canada thistle and field bindweed.

Uptake and Translocation: Contact and systemic. Absorption occurs through foliage and roots.

Basis of Selectivity: Metabolism by soybeans.

Application Methods: Postemergence.

Unique Characteristics: A liquid ammonium fertilizer solution (such as UAN) must be added at 2 L/ha. Some rotational restrictions apply. See label for details. Refer to notes on imazethapyr and BENTAZON for additional information on each component.

IMAZETHAPYR + METRIBUZIN

Trade Name: CONQUEST LQ (co-pack of CONQUEST A + CONQUEST B).

Chemical Family: Imidazolinone+s-triazine.

Crop and/or Non-Crop Registrations: Soybeans.

Sensitive Weeds: Annual grass and broadleaf species. See label for specific species controlled.

Application Methods: Early preplant incorporated and preemergence.

Unique Characteristics: Some rotational restrictions apply. See label for details. Refer to notes on imazethapyr and metribuzin for additional information on each component.

INDAZIFLAM

Trade Name: ALION 200 SC.

Chemical Family: Alkylazine.

Crop and/or Non-Crop Registrations: Apples, apricots, cherries, grapes, nectarines, plums, peaches, pears and tree nuts.

Sensitive Weeds: Barnyard grass, giant foxtail, green foxtail, Italian ryegrass, large crabgrass, wild proso millet, witchgrass, yellow foxtail, annual sow-thistle, black mustard, common groundsel, field bindweed, lamb's-quarters, prickly lettuce (suppression only), redroot pigweed (suppression only), shepherd's purse, spotted spurge, stork's-bill, white sweetclover, wild mustard.

Uptake and translocation: Absorbed by roots of germinating weeds. Rain or irrigation is necessary for activation. Best control is achieved if received within 3 weeks after application.

Basis of Selectivity: Established roots and roots below level of Alion in soil.

Application Methods: Pre-emergent to weeds. Apply to established crops of at least three full growing seasons. Applied alone, Alion will not control weeds that are already emerged.

Unique Characteristics: Alion is a residual product. If there is heavy weed pressure, emerged weeds will tie up the Alion, reducing residual herbicide actvity. In the case of heavy weed infestation and very little bare ground, apply a burndown product alone, then once the weeds have died or shrivelled – apply Alion alone **ONLY** if you are confident there are no emerged weeds at the time of application **OR** apply Alion in tank-mix with a burndown to control any small emerged weeds.

ISOXAFLUTOLE + ATRAZINE

Trade Name: CONVERGE XT (co-pack CONVERGE FLEXX + CONVERGE 480), or tank-mix of CONVERGE FLEXX + atrazine 480.

Chemical Family: Isoxazole + s-triazine.

Crop and/or Non-Crop Registrations: Corn, field and seed.

Sensitive Weeds: Annual grasses and broadleaf weeds including triazine and ALS inhibitor tolerant biotypes: green, yellow and giant foxtail, barnyard grass, witchgrass, large and smooth crabgrass, lamb's-quarters, pigweed, common ragweed, eastern black nightshade, velvetleaf, wild mustard, wormseed mustard, wild buckwheat, lady's-thumb, sow-thistle (annual and spiny annual) seedling dandelion and seedling plantain.

Uptake and Translocation: Absorbed by roots and shoots of germinating weeds.

Basis of Selectivity: Metabolized by tolerant species. Preemergence and early postemergence up to the 3 leaf stage of corn. Provides season long weed control. Winter wheat can be grown 4 months after application, corn, soybeans, spring cereals, alfalfa, spring canola and processing peas can be grown the following year. Weed seedlings that emerge prior to activation of herbicide by rainfall can be controlled if less than 5 cm in height. NOT for use on sandy loam or finer textured soils with a minimum of 2% organic matter.

ISOXABEN

Trade Name: GALLERY.

Chemical Family: Benzamide.

Crop and/or Non-Crop Registrations: Bareroot and container conifer seedlings.

Sensitive Weeds: St. John's-wort, pineappleweed, lamb's-quarters, purslane, shepherd's-purse, low cud-weed and purslane speedwell.

Uptake and Translocation: Absorbed by roots and translocated to the shoots of germinating weeds.

Basis of Selectivity: Root selectivity.

Application Methods: Applied prior to weed emergence in conifers, 4 or more weeks after crop germination and emergence. Rainfall or irrigation is needed to activate the herbicide.

Residual Activity: Provides season-long control. Germination of some sensitive crop species may be reduced in the year following treatment.

Unique Characteristics: Gallery is registered for use only by members of the Canadian Forest Nursery Weed Management Association.

LINURON

Trade Name: LOROX DF, LOROX L.

Chemical Family: Substituted urea.

Crop and/or Non-Crop Registrations: Corn, soybeans, carrots, celery, dill, parsnips, potatoes, asparagus, caraway, coriander, sweet white lupins, wheat, oats, barley, gladioli, fruit trees.

Sensitive Weeds: Annual weeds such as barnyard grass, common chickweed, corn spurry, crabgrass, velvetleaf, fall panicum, foxtail, goosefoot, goose grass, groundsel, knotweed, lamb's-quarters, redroot pigweed, purslane, common ragweed, shepherd's-purse, smartweed, stinkweed, wild buckwheat, witchgrass, wormseed mustard, triazine-resistant weeds; seedlings only of dandelion, plantain and sow-thistle.

Uptake and Translocation: Readily absorbed through roots, less so through foliage; translocation primarily upwards in xylem.

Basis of Selectivity: Differential metabolism often coupled with differential uptake and translocation.

Application Methods: Preemergence, postemergence, directed postemergence, pre plus postemergence.

Residual Activity: Does not pose a problem for subsequent crops since phytotoxic residues from applications at agricultural rates disappear within 4 months.

Unique Characteristics: Do not use on sandy or coarse-textured soils having less than 2% organic matter. If unusually heavy rains follow application, severe injury may occur to corn, soybeans, carrots and potatoes.

MCPA

Trade Names: MCPA ESTER 600, MCPA ESTER 500, MCPA SODIUM 300, MCPA AMINE 500, MCPA AMINE 600, TROPHY B.

Chemical Family: Phenoxy.

Crop and/or Non-Crop Registrations: Cereal crops, turf, non-crop sites.

Sensitive Weeds: Many broadleaf weeds, especially buttercup, hemp-nettle, field horsetail (top growth only), seedling dock.

Uptake and Translocation: Absorbed through leaves or roots. Translocates to, and accumulates at, growing points of shoots and roots.

Basis of Selectivity: Differences in interception, penetration, translocation, metabolism and sensitivity of active sites leads to greater activity in broadleaf weeds than grasses.

Application Methods: Postemergence.

Residual Activity: Some soil residues can be detected for up to 1 month under moist conditions and 6 months in drier climates.

Unique Characteristics: MCPA is available in amine ester or sodium salt formulations. It is safer than 2,4-D for use on oats, flax and peas. As with 2,4-D, there is a potential drift hazard to nearby susceptible crops such as grapes, turnips, tobacco and cabbage.

MCPB/MCPA

Trade Name: CLOVITOX PLUS, TOPSIDE, TROPOTOX PLUS.

Chemical Family: Phenoxy/phenoxy.

Crop and/or Non-Crop Registrations: Seedling white, ladino, alsike or red clovers direct seeded or underseeded in wheat, oats, barley, rye, pastures, field corn, peas, grapes (not TOPSIDE).

Sensitive Weeds: Small emerged mustards, stinkweed, ragweed, lamb's-quarters, redroot pigweed, shepherd's-purse, volunteer rapeseed, wild radish, hemp-nettle, annual sow-thistle; top-growth control of bull thistle, Canada thistle, curled dock, plantain, perennial sow-thistle, field bindweed, horsetail, buttercup.

Uptake and Translocation: Absorbed through the foliage and readily translocated, especially to the growing points.

Basis of Selectivity: MCPB is not directly toxic to plants. Susceptible weeds convert MCPB to MCPA.

Application Methods: Postemergence. In cereals, clovers and peas, apply as an overall spray. In corn, apply with drop pipes after the corn reaches 45 cm before the beginning of tasselling. Apply to pastures after grazing or cutting.

MECOPROP-P

Trade Names: COMPITOX, MECOPROP.

Chemical Family: Phenoxy.

Crop and/or Non-Crop Registrations: Cereals, turf.

Sensitive Weeds: Many broadleaf weeds such as chickweed, cleavers, plantain, clover, corn spurry, stitchwort, black medick, knotweed, shepherd's-purse, buttercup, Canada thistle (top-growth control) and dandelion. For complete control of Canada thistle, dandelion and black medick, a repeat application will likely be required.

Uptake and Translocation: Absorbed readily by foliage and translocated to roots and throughout shoots, especially to growing points.

Basis of Selectivity: Differences in interception, penetration, translocation, metabolism and sensitivity of active sites result in broadleaf species being more sensitive than grasses.

Application Methods: Postemergence. Apply to cereals between the 3 leaf and early flag-leaf stage. In turf, apply when weeds are actively growing.

Residual Activity: Can persist in soil up to 4 weeks, however, grass can normally be seeded within 1–2 weeks after treatment.

Unique Characteristics: Controls 2,4-D-resistant weeds such as chickweed, clovers, black medick and young knotweed. Do not spray on grain underseeded to legumes. If cereals are stressed at the time of application, deformed heads and missing florets may result. Can be safely used on bentgrass, however, injury may occur if temperature is above 27°C. Effectiveness will be reduced if rain occurs within 4–6 hours after treatment.

MECOPROP-P/2,4-D

Trade Names: IPCO PREMIUM 2–WAY XP TURF HERBICIDE, TURF-RITE 2+2.

Chemical Family: Phenoxy/phenoxy.

Crop and/or Non-Crop Registrations: Turf.

Sensitive Weeds: Many broadleaf weeds such as chickweed, cleavers, plantain, clover, corn spurry, stitchwort, black medick, knotweed, shepherd's-purse, buttercup, Canada thistle (top-growth control) and dandelion.

Uptake and Translocation: Absorbed through leaves and roots, translocates to growing points.

Basis of Selectivity: Differences in interception, penetration, translocation, metabolism and sensitivity of active sites result in broadleaf species being more sensitive than grasses.

Application Methods: Postemergence. Apply when weeds are actively growing.

MESOTRIONE

Trade Name: CALLISTO.

Chemical Family: Triketone.

Crop and/or Non-Crop Registrations: Asparagus, corn (field, seed and sweet), highbush blueberries, cranberries and sod production.

Sensitive Weeds (when tank-mixed with atrazine): Cocklebur (emerged), common ragweed, giant ragweed (emerged), lamb's-quarters, redroot pigweed, tall waterhemp, velvetleaf , volunteer adzuki bean (emerged).

Uptake and Translocation: Readily absorbed by, shoots, roots, stems and leaves and then translocated to other plant parts.

Basis of Selectivity: Inhibits the HPPD enzyme found in photosynthetic cells of susceptible species. Symptoms on susceptible plants are bleaching followed by necrosis. Tolerant species rapidly metabolize mesotrione.

Application Methods: Preemergence and postemergence up to the 8 leaf stage of field, seed and sweet corn. Postemergence applications to corn require the addition of a non-ionic surfactant. Apply to blueberries and cranberry beds preemergence and postemergence to weeds.

Residual Activity: Degradation primarily by soil microbial action. Mesotrione will provide residual control of annual broadleaf weeds.

Unique Characteristics: When mesotrione is tank-mixed with atrazine there is a synergistic effect and improved control of broadleaf weed species. Mesotrione can be tank-mixed with either a soil applied or postemergence grass herbicide for one-pass weed control. Mesotrione has low volatility and poses a reduced risk to nearby sensitive crops.

MESOTRIONE/GLYPHOSATE

Trade Name: CALLISTO GT.

Chemical Family: Triketone, Amino acid.

Crop and/or Non-Crop Registrations: Corn (glyphosate tolerant hyrbids only)

Application Methods: Preemergence and postemergence up to the 8 leaf stage of corn.

Unique characteristics: In addition to broad-spectrum burn-down of emerged weeds, CALLISTO GT will provide residual control of Eastern Black Nightshade, redroot pigweed, velvetleaf and suppression of common ragweed.

For all other information: Refer to mesotrione and glyphosate alone.

METAM SODIUM

Trade Name: VAPAM.

Chemical Family: Thiocarbamate.

Crop and/or Non-Crop Registrations: Field and greenhouse seedbeds. Field-replant sites of fruits, vegetables, tobacco, ornamentals and forest-tree stock.

Sensitive Weeds: Most scarified weed seeds and freshly vegetative parts including rhizomes and germinating seedlings.

Basis of Selectivity: Most plant parts are sensitive. Crops are not planted until all fumigant has dissipated from the soil. With moisture, methyl isothiocyanate gas is released, which kills most scarified seeds and fleshy vegetative parts including rhizomes and germinating seedlings.

Application Methods: Apply uniformly using injectors, water or other incorporation tools to carry the product to the desired soil depth. May be applied via the irrigation system. No gas-proof cover is required unless the soil is very porous, however, a sprinkler application of water should be used to provide a surface "water seal".

Residual Activity: 10–40 days depending on soil temperature and the amount of organic matter present in the soil. Persistence is greatest at low temperatures and high levels of organic matter. Planting may take place 12–16 days after the treatment and following a lettuce-seedling bioassay that indicates no injury.

Unique Characteristics: Also controls nematodes, soil fungi and soil insects. All traces of toxic gases must be dissipated from the treated soil before planting or plant injury may occur.

METOLACHLOR

See S-METOLACHLOR, page 66.

METOLACHLOR/ATRAZINE

See S-METOLACHLOR/ATRAZINE, page 67.

METRIBUZIN

Trade Names: CONQUEST A (Available only in CONQUEST LQ co-pack), SENCOR 480 F, SENCOR 75 DF.

Chemical Family: S-triazine.

Crop and/or Non-Crop Registrations: Apples, apricots, asparagus, (established), blueberries (highbush), carrots, cherries, corn (field), faba beans, peaches, plums, potatoes, soybeans and transplant tomatoes (fresh market and processing).

Sensitive Weeds: Lamb's-quarters, wild mustard, redroot pigweed, common ragweed, shepherd's-purse, lady's-thumb, velvetleaf, jimsonweed, prostrate pigweed, Russian thistle, yellow wood-sorrel, prickly mallow, chickweed, cocklebur, carpetweed, dandelion seedlings, barnyard grass, crabgrass, foxtail, fall panicum, witchgrass, Johnson grass seedlings and cheat grass.

Uptake and Translocation: Some uptake through the foliage but the major route is via the roots. Translocation upwards in the xylem.

Basis of Selectivity: Degradation by tolerant species.

Application Methods: Preplant incorporated (potatoes, soybeans, apples, apricots, peaches, cherries, pears, plums, corn, and tomatoes); preemergence (asparagus, potatoes, soybeans apples, apricots, blueberries, cherries, peaches, pears, plums); postemergence (potatoes, tomatoes, corn).

Residual Activity: Varies with the climate. At normal-use rates the half-life is 1–2 months.

Unique Characteristics: Heavy rainfall following application may cause crop damage. Some varieties of potato, soybean and tomato are less tolerant than others. Triazine-resistant weeds are not controlled. Do not use on muck soils.

METSULFORN-METHYL/ AMINOCYCLOPYRACHLOR

Trade Name: NAVIUS HERBICIDE.

Chemical family: Sulfonylurea/pyrimidine carboxylic acids.

Crop and/or Non-Crop Registrations: Rangeland and non-crop sites.

Sensitive Weeds: annual sowthistle, Bluebur, buttercup (giant), Canada thistle , Common chickweed, Common groundsel, Common tansy, Common yarrow, Corn spurry, Cow cockle, Dandelion, Field bindweed, Field horsetail, Flixweed, Giant hogweed, Green smartweed, Hemp-nettle, Kochia (including ALS-resistant), Knapweed (diffuse, spotted), Lady's-thumb, Leafy spurge, Norwegian cinquefoil, Orange hawkweed, Ox-eye daisy, Perennial sowthistle, Prostrate pigweed, Redroot pigweed, Russian thistle, Scentless chamomile, Shepherd's purse, Stinkweed, Stork's bill, Sumac (Smooth, Staghorn), Sweet clover (White, Yellow), Volunteer canola (except Clearfield varities), Western snowberry, White cockle, Wild carrot, Wild mustard, Wild rose, Yellow starthistle.

Application Methods: Apply to young emerged weeds that are actively growing.

Residual Activity: Provides residual control that will generally result in season long control of sensitive weeds.

NAPROPAMIDE

Trade Names: DEVRINOL 50 DF, DEVRINOL 2G, DEVRINOL 10G, DEVRINOL DF-XT.

Chemical Family: Amide.

Crop and/or Non-Crop Registrations: Asparagus, cole crops (cabbage, broccoli, cauliflower, Chinese broccoli, Chinese mustard greens, Chinese Nappa cabbage, Chinese radish), garlic, kohlrabi, peppers, pumpkin, squash, fuzzy squash, rutabagas, tomatoes, tobacco, raspberries, blackberries, cultivated lowbush blueberries, established highbush blueberries, boysenberries, cranberries, loganberries, newly planted or established strawberries, apples, grapes, peaches and pears, newly transplanted or established ornamentals, woody nursery stock, forest tree stock, ground covers and container-grown ornamentals (see label for species). Apply with simazine or with terbacil on new plantings of apples, apricots, cherries, plums, peaches and pears.

Sensitive Weeds: Many annual weeds including crabgrass, barnyard grass, annual bluegrass, foxtails, sandbur, wild oats, goose grass, chickweed, groundsel, redroot pigweed, lamb's-quarters, purslane, prostrate knotweed, pineappleweed and prickly lettuce.

Uptake and Translocation: Absorbed through the roots of germinating weeds. Translocated upward through seedling.

Basis of Selectivity: Metabolized by tolerant species. Root growth of germinating seedlings is inhibited. Established plants are not affected due to placement selectivity.

Application Methods: May be applied preplant incorporated using water as the carrier. Incorporation should be uniform, and to a chemical depth of 2.5–5 cm, using irrigation or proper incorporation equipment (e.g., tandem discs or field cultivator with sweep teeth) followed by a levelling device. On established crops, apply to a weed-free soil surface and irrigate in if no rainfall occurs within 7 days after application in spring or fall, or within 2 days after application in summer; irrigate with sufficient water to wet the soil to a depth of 5–10 cm (approximately 7 mm of rain). For post-plant application in tobacco, apply in 25 cm band over the row. Cross-disc or cross-plough after harvest to dilute soil residue before planting cover crop.

Residual Activity: Provides season-long weed control if properly incorporated. Deep ploughing will minimize any carryover effect.

Unique Characteristics: Will not control germinated weeds. Resists leaching. To avoid injury to crops not registered for use with napropamide, do not plant until 12 months after the last napropamide application.

NICOSULFURON

Trade Name: ACCENT.

Chemical Family: Sulfonylurea.

Crop and/or Non-Crop Registrations: Field corn, certain varieties of sweet corn (refer to product label), and seed corn (contact seed source for details on specific inbreds).

Sensitive Weeds: Quackgrass, proso millet, green and yellow foxtail, fall panicum, barnyard grass, witchgrass. Control of yellow foxtail is only achieved with either the addition of MERGE or the addition of 28% UAN at a rate of 5 L/ha along with a labelled non-ionic surfactant.

Uptake and Translocation: Following foliar absorption, nicosulfuron is rapidly absorbed through the leaves and translocated in both xylem and phloem.

Basis of Selectivity: Inhibition of acetolactate synthase (ALS) enzyme in susceptible plants leads to a rapid cessation of cell division and regrowth. Tolerant species rapidly convert nicosulfuron to non-phytotoxic metabolites.

Application Method: Postemergent within the 1–8 leaf stage of corn.

Residual Activity: No soil residual activity.

Unique Characteristics: Emerged grasses will be controlled by nicosulfuron but subsequent germinating grasses will not be controlled. A non-ionic surfactant must be added at 0.2% v/v. Typical symptoms of plant death (chlorosis, necrosis) occur 5–10 days after application, depending on growing conditions. Do not apply to corn that has been treated with an organophosphorus soil insecticide.

NICOSULFURON + DIFLUFENZOPYR/DICAMBA

Trade Name: ACCENT TOTAL (co-pack of ACCENT + DISTINCT).

Chemical Family: Sulfonylurea + Semicarbazone/Benzoic acid.

Crop and/or Non-Crop Registrations: Corn.

Application Methods: Postemeregent, from the 2–8 leaf stage of corn.

For All Other Information: Refer to nicosulfuron and dicamba/diflufenzopyr alone.

NICOSULFURON/RIMSULFURON

Trade Name: ULTIM.

Chemical Family: Sulfonylurea/Sulfonylurea.

Crop and/or Non-Crop Registrations: Field corn. Not for use on sweet or seed corn.

Sensitive Weeds: Quackgrass, proso millet, green and yellow foxtail, fall panicum, barnyard grass, witchgrass, redroot pigweed (incl. triazine-resistant).

Uptake and Translocation: Following foliar application, nicosulfuron/rimsulfuron rapidly absorbed through the leaves and translocated in both xylem and phloem.

Basis of Selectivity: Inhibition of acetolactate synthase (ALS) enzyme in susceptible plants leads to a rapid cessation of cell division and growth. Tolerant species rapidly convert nicosulfuron/rimsulfuron to non-phytotoxic metabolites.

Application Method: Postemergence, within the 1–6 leaf stage of corn.

Residual Activity: Rapid soil microbial degradation of nicosulfuron. Refer to notes on rimsulfuron for information on its soil residual activity.

Unique Characteristics: Emerged grasses will be controlled by nicosulfuron/rimsulfuron, but subsequent germinating grass weeds will not be controlled. A non-ionic surfactant must be added at 0.2% v/v. Typical symptoms of plant death (chlorosis, necrosis) occur 5–10 days after application, depending on growing conditions. Do not use on corn hybrids with a crop heat unit (CHU) rating of 2,500 or less, or in geographic regions with 2,500 or less average seasonal CHU.

NICOSULFURON/RIMSULFURON + DIFLUFENZOPYR/DICAMBA

Trade Name: ULTIM TOTAL (co-pack of ULTIM + DISTINCT).

Chemical Family: Sulfonylurea + Semicarbazone/Benzoic acid.

Crop and/or Non-Crop Registrations: Corn.

Application Methods: Postemeregence, up to the 6 leaf stage of corn.

For All Other Information: Refer to nicosulfuron/rimsulfuron and dicamba/diflufenzopyr alone.

NICOSULFURON/RIMSULFURON + GLYPHOSATE

Trade Name: GALAXY 2 (co-pack of ULTIM + POLARIS).

Chemical Family: Sulfonylurea + Amino acid.

Crop and/or Non-Crop Registrations: Glyphosate Tolerant ("Roundup Ready") Corn only.

Application Methods: Postemeregence, up to the 6 leaf stage of corn.

For All Other Information: Refer to notes on nicosulfuron/rimsulfuron and glyphosate for additional information on each component.

NICOSULFURON/RIMSULFURON + MESOTRIONE

Trade Name: DESTRA (co-pack of DESTRA 75 + MESOTRIONE 480 SC).

Chemical Family: Sulfonylurea + Triketone.

Crop and/or Non-Crop Registrations: Corn.

Application Methods: Postemeregence, up to the 6 leaf stage of corn.

For All Other Information: Refer to nicosulfuron/rimsulfuron and meostrione alone.

OXADIAZON

Trade Name: RONSTAR 2G.

Chemical Family: Oxadiazole.

Crop and/or Non-Crop Registrations: Woody ornamental shrubs, vines and trees grown in containers.

Sensitive Weeds: Annual weeds including stinkweed, bittercress, common groundsel, lamb's-quarters, purslane, eastern black nightshade, pigweeds, redroot, tumble, shepherd's-purse, annual bluegrass, barnyard grass, green and yellow foxtails and crabgrass.

Uptake and Translocation: Primarily taken up through emerging shoots when they penetrate through the treated soil layer.

Basis of Selectivity: Greater physiological tolerance relative to susceptible species and lack of contact with sensitive crop tissue.

Application Method: Applications may be made to both newly transplanted and established ornamentals preemergent to weed germination. Existing weed growth must be removed for satisfactory weed control.

Residual Activity: 60–120 days.

Unique Characteristics: When applied to soil, the material is rapidly and strongly fixed by soil colloids. Due to its low water solubility and to this adsorption, the downward and lateral movement is limited under the influence of rain or irrigation. Therefore, the chemical must be applied uniformly for satisfactory weed control. Moisture is required to activate the chemical. Rainfall or overhead irrigation after application will improve weed control.

OXYFLUORFEN

Trade Name: GOAL 2XL.

Chemical Family: Diphenyl ether.

Crop and/or Non-Crop Registrations: Broccoli, cabbage, cauliflower, conifers, onions, raspberries, and strawberries.

Sensitive Weeds: Purslane, pigweed, annual nightshades, wild buckwheat, lamb's-quarters, field violet, wood-sorrels.

Uptake and Translocation: Primarily foliar absorption but some root absorption. Very little movement within the plant following foliar or root absorption.

Application Methods: Postemergence. Best control is obtained when weeds are in the 2–4 leaf stage and actively growing. The first application can be made when onions have 2 fully developed true leaves. Repeat applications may be necessary to control late-germinating weeds. Apply as a single pre-mulching spray to dormant strawberry plants. Use at least 500 L of water/ha.

Residual Activity: Limited preemergence activity.

Unique Characteristics: Use on dry bulb onions. Do not use when crop or weeds are under stress. Do not apply within 56 days prior to harvest for onions, or within 150 days prior to harvest for strawberries.

PARAQUAT

Trade Name: GRAMOXONE.

Chemical Family: Bipyridylium.

Crop and/or Non-Crop Registrations: Apples, apricots, cherries, currants, gooseberries, grapes, highbush blueberries, peaches, pears and plums established more than 1 year; blackberries, loganberries and red raspberries; inter-row spraying in strawberries; established shelterbelts, filberts and hazelnuts, stale seedbed technique for vegetables and field crops; inter-row directed chemical weeding for vegetable fields and established nursery crops; asparagus; potatoes; established alfalfa and bird's-foot trefoil; pasture renovation; zero tillage corn and soybean; conifer control.

Sensitive Weeds: Non-selective – affects all green plants.

Uptake and Translocation: Absorbed by foliage and green bark; little or no translocation.

Basis of Selectivity: All green plant tissue is sensitive. Less effective on plants with a very waxy cuticle and linear leaf shape such as nutsedge. Safe on mature (non-green) bark of woody plants.

Application Methods: Postemergence. Broadcast, or directed spray to avoid contacting leaves or bark of desirable plants. Apply when weeds are less than 15 cm high. Better results are usually obtained if application is made on a dull or cloudy day, or in the evening.

Residual Activity: Essentially no residual activity in soil. Will persist in organic material such as mulches or turf thatch; therefore, do not reseed these areas for 5 days. More than 1 application per season may be necessary, especially for perennial weeds.

Unique Characteristics: Inactivated by adsorption to soil particles.

PENDIMETHALIN

Trade Name: PROWL 400, PROWL H2O.

Chemical Family: Dinitroaniline.

Crop and/or Non-crop Registrations: Carrots, onions, (green and dry bulb), edible beans (snap, lima and adzuki), field corn, leeks and soybean.

Sensitive Weeds: Green foxtail, crabgrass, barnyard grass, fall panicum, lamb's-quarters and pigweed (suppression).

Uptake and Translocation: Weeds are controlled as they germinate. Translocation is not significant and emerged weeds are not controlled.

Basis of Selectivity: No significant uptake or translocation by the crop.

Application Methods: Onions: postemergence to the crop at loop and 2 leaf stage. Field corn: preemergence and early postemergence. For preemergence application, pendimethalin may be applied in water or liquid fertilizer. Conduct a fertilizer compatibility test using pendimethalin and any of its registered tank-mix partners. Early postemergence application may only use water as a carrier.

Residual Activity: Persistence depends on weather conditions (more persistent under dry conditions). Only registered crops may be planted in the year of application. Soybeans and corn may be planted the year following application in corn. Days to harvest restriction: 100 days.

Unique Characteristics: Strongly adsorbed to soil particles. Most effective when rain is received within 7 days of application. For onions, apply at both growth stages for season-long control. Tank-mixes in corn or sequential application of other herbicides in onions and corn are required for broad-spectrum weed control. Registered for dry bulb onions grown on muck and mineral soils . Do not graze treated fields or feed treated foliage to livestock prior to 100 days after PROWL application.

PICLORAM/2,4-D

Trade Name: TORDON 101.

Chemical Family: Pyridine/phenoxy.

Crop and/or Non-Crop Registrations: Weed and brush (including conifer) control in non-crop locations, industrial sites and rights-of-way.

Sensitive Weeds: Most broadleaf herbaceous weeds including Canada thistle, sweet and red clover, wild carrot, common ragweed, dandelion, goldenrod, dock, plantain, prickly lettuce, burdock, fleabane and vetch; deciduous and coniferous woody plants except white ash.

Uptake and Translocation: Rapidly absorbed by the roots, stems and foliage. Translocation can be up or down but, like 2,4-D, accumulation is in young, rapidly growing meristematic tissue.

Basis of Selectivity: Effects on nucleic acid metabolism and growth are not observed in grasses and other tolerant species.

Application Methods: For deciduous and coniferous brush, apply either broadcast using a fixed nozzle (constant volume per hectare) or selectively using a spray gun (variable volume per hectare). As spray gun applications use a more dilute spray mix, this type of application must thoroughly wet the foliage, stem and root collar. Brush should be treated after foliage is well developed in spring or early summer. To ensure thorough coverage and minimize drift, brush to be treated should be less than 2.5 m tall. For cut-surface treatment, mix with water or ethylene glycol (to reduce the freezing point, if necessary) and apply to cover the cambium layer of freshly cut stumps. For broadleaf herbaceous weeds, apply broadcast in spring or early summer after growth begins.

Residual Activity: Soil residue carryover into the year following application is minimal when applied at labelled rates. Degradation is most rapid under warm, humid conditions. Because small residues of picloram in soil can be phytotoxic to crops such as soybeans, tobacco, tomatoes, potatoes, grapes and many desirable ornamental plants, picloram may not be applied to land used, or land that may be used, for the production of agricultural and horticultural crops.

Unique Characteristics: A permit from the Ministry of the Environment is required to purchase and use picloram/2,4-D in Ontario. Picloram/2,4-D must not be applied over, or near, areas where roots of desirable trees or other plants may extend. Because spray drift is phytotoxic to sensitive plants, an approved drift-control system or additive is advisable when making low-volume applications adjacent to desirable trees or crops.

PINOXADEN

Trade Name: AXIAL BIA.

Chemical Family: Phenylpyrazolin.

Crop and/or Non-Crop Registrations: Spring wheat, winter wheat, spring barley.

Sensitive Weeds: Wild oats, green foxtail, yellow foxtail, barnyard grass, volunteer oats, volunteer cananary seed, proso millet

Uptake and Translocation: Absorbed through foliage and translocates to the site of action in the meristematic growing tissue.

Application Methods: Postemergence from the 1 leaf to flag leaf stage of cereals.

Residual Activity: Essentially none.

PROMETRYNE

Trade Name: GESAGARD.

Chemical Family: S-triazine.

Crop and/or Non-Crop Registrations: Carrots, peas, leeks, and transplanted celery.

Sensitive Weeds: Lamb's-quarters, lady's-thumb, corn spurry, pigweed, wild mustard, purslane, eastern black nightshade, chickweed, hemp-nettle and green foxtail.

Uptake and Translocation: Absorbed through foliage and roots. Translocated upwards through xylem, accumulating in the apical meristems.

Basis of Selectivity: Metabolized by tolerant plants and to a lesser extent by sensitive plants, although this is not thought to be the major selective mechanism.

Application Methods: Preemergence or early postemergence (before weeds are 5 cm high). Apply before carrots or peas emerge. Apply 7–14 days after celery is transplanted.

Residual Activity: About 6–8 weeks. A fall cover crop of rye or oats may be sown on the treated land in the same season.

PROPYZAMIDE

Trade Name: KERB.

Chemical Family: Amide.

Crop and/or Non-Crop Registrations: Alfalfa, bird's-foot trefoil, woody nursery stock, lettuce, apples, pears, lowbush blueberries.

Sensitive Weeds: Perennial grasses including quackgrass, annual grasses, volunteer cereals and common chickweed.

Uptake and Translocation: Taken up by plant roots and translocated to the foliage. Little foliar absorption.

Basis of Selectivity: Faster degradation in tolerant species.

Application Methods: Preemergence to annual weeds. Postemergence control of perennial grasses when applied in the fall. Apply in the fall from late September to early November when the soil temperature is low but above freezing, and soil moisture is high.

Residual Activity: Persistence is variable (2–9 months), depending on soil type and climatic conditions. Decomposition of the herbicide is slow at temperatures below 15°C but accelerates at temperatures above this level. Persistence is greatest in sandy soils with low organic matter.

Unique Characteristics: Rainfall or irrigation is required after application to move the herbicide into the root zone for uptake by perennial grasses and germinating annual grasses.

PROSULFURON

Trade Name: PEAK 75WG.

Chemical Family: Sulfonyl urea.

Crop and/or Non-Crop Registrations: Corn (field and seed), sorghum, millet and wheat (winter).

Sensitive Weeds: Lamb's-quarters (including triazine tolerant), redroot pigweed, cocklebur, lady's thumb, wild buckwheat, wild mustard, velvetleaf, common ragweed.

Uptake and Translocation: Following foliar application and uptake, prosulfuron is translocated through phloem to meristematic tissues. Growth of susceptible species ceases rapidly, followed by discolouration of leaves; death takes 1–3 weeks to occur.

Basis of Selectivity: Inhibition of the enzyme acetolactate synthase. Tolerant species rapidly metabolize prosulfuron.

Application Methods: Postemergent, corn (2–7 leaf stage), sorghum and millet (3–5 leaf stage) and winter wheat (up to stem elongation).

Residual Activity: Degradation primarily by soil microbial action. Prosulfuron will provide a sufficient degree of control of later germinating broadleaf weeds. Approved rotational crops are soybeans, dry beans, peas, cereals, and corn. See the label and Tables 4–4 and 4–5. *Herbicide Crop Rotation and Soil pH Restrictions*, page 74 and page 76, for information on rotational crop restrictions.

Unique Characteristics: Prosulfuron must be applied in a tank-mix combination with a reduced rate of dicamba in corn (field and sweet), millet and sorghum. Prosulfuron must be tank-mixed with bromoxynil in winter wheat. Refer to each crop section for more information on applicable rates and adjuvants.

PYRASULFOTOLE/BROMOXYNIL

Trade Name: INFINITY.

Chemical Family: Benzoylpyrazole and hydroxybenzonitrile.

Crop and/or Non-Crop Registrations: Wheat (spring, durum winter), barley, triticale and timothy (seed production only).

Sensitive Weeds: Annual broadleaf weeds including ALS (Group 2) resistant biotypes: annual sow-thistle, chickweed, cleavers, common ragweed, flixweed, hemp-nettle, kochia, lamb's-quarters, pale smartweed, redroot pigweed, suppression of round-leaf mallow giant ragweed and spreading atriplex, Russian thistle, shepherd's purse, stinkweed, volunteer canola (conventional and herbicide tolerant), wild buckwheat and wild mustard. Suppression of perennial weeds including: Canada thistle, dandelion, perennial sow-thistle.

Basis of Selectivity: Metabolism by tolerant species.

Application Methods: Postemergence – Apply to emerged, young, actively growing weeds. Under cool and/or dry conditions activity may be reduced or delayed. Weed control may also be reduced if application is made when weeds are dust covered or in the presence of heavy dew, fog, or mist/rain. Apply in a minimum of 46.8 L of water/ha at a pressure of 275 kPa. Crops may be treated from the 1 leaf stage of growth until the flag leaf is just visible but still rolled.

Residual Activity: Essentially none.

Unique Characteristics: Application beyond emergence of the flag leaf may result in crop injury. Do not apply to a crop that is stressed by severe weather conditions, frost, low fertility, drought, water-saturated soil, disease or insect damage, as crop injury may result. Do not apply to crops under-seeded with legume species. Do not store below -20°C.

PYROXASULFONE + CARFENTRAZONE-THYL

Trade Name: FOCUS.

Chemical Family: Isoxazoline/ Aryl triazolinone.

Crop Registrations: Field corn and soybeans.

Sensitive Weeds: Barnyard grass, crabgrass (smooth, large), foxtail (giant, green, yellow), witchgrass, buckwheat wild, nightshade and pigweed.

Basis of Selectivity: Metabolized by tolerant species.

Application Methods: : Early preplant, preplant shallow incorporated and preemergence. Rainfall within 10 days is required for maximum activity of the preemergent application.

Residual Activity: Provides season long control of labeled weeds and is dependent on soil type, moisture and rate of application.

Unique Characteristics: The rate of application depends on weed pressure . Lack of moisture or too much moisture can affect activity. Winter cereals may be planted 4 months after application. Good tank mix partner with other herbicides.

PYRAZON

Trade Name: PYRAMIN FL.

Chemical Family: Pyridazinone.

Crop and/or Non-Crop Registrations: Sugar beets and table beets. Apply with NORTRON on sugar beets.

Sensitive Weeds: Annual nightshades, chickweed, knotweed, lady's-thumb, lamb's-quarters, oak-leaved goosefoot, prostrate pigweed, purslane, ragweed, redroot pigweed, shepherd's-purse, smartweed, stinkweed, wild buckwheat, wild carrot (seedling), wild mustard, wormseed mustard and yellow rocket (seedling).

Uptake and Translocation: Can be taken up by both roots and leaves, but translocation is upward to leaves where it inhibits photosynthesis.

Basis of Selectivity: Metabolism by tolerant species.

Application Methods: Preplant incorporated, preemergence, or postemergence after the second true-leaf stage of the beets.

Residual Activity: Average persistence is about 4–8 weeks in soil, depending on soil moisture and temperature. Residue carryover problems are unlikely.

Unique Characteristics: With preemergence applications, at least 1.25 cm of rainfall is required for good weed control. Combinations of pyrazon and TCA are most useful where both annual broadleaf weeds and grasses are a problem. These treatments may not be effective on high organic soils or dry soils (i.e., muck soils or with late planted beets when soils are drier). Under these circumstances, postemergence applications of pyrazon plus TCA as a band over the row may be most effective. However, to be selective and effective the chemicals must be applied after the cotyledons of the beets are 2.5 cm long and before the weeds have reached the 4 true-leaf stage (10 cm). Where TCA has been used, do not feed beet tops to livestock. TCA residues in the soil can be a problem for some crops such as corn.

QUIZALOFOP-P-ETHYL

Trade Name: ASSURE II.

Chemical Family: Aryloxyphenoxypropionate.

Crop and/or Non-Crop Registrations: Brassica carinata, canola, clover (red and alsike), crambe, flax, a number of different edible bean market classes, refer to Table 7–1. *Beans (Adzuki, Dry, Lima and Snap) Weed Control Ratings,* page 101 for specific crop registrations, faba beans, narrowleaf lupin, mustard, peas, rutabagus, industrial fibre hemp, seed alfalfa, soybeans, sugar beets and sunflower.

Sensitive Weeds: Green foxtail, barnyard grass, fall panicum, foxtail barley, witchgrass, proso millet, wild oats, volunteer cereals and volunteer corn.

Uptake And Translocation: Rapidly absorbed and readily translocated in both the xylem and phloem from the treated foliage to the root system and growing points of the plant.

Basis of Selectivity: Disruption of fatty acid biosynthesis leading to increased permeability and cellular disruption in sensitive plants. Rapid metabolism of the active herbicide in tolerant species.

Application Methods: Postemergence.

Residual Activity: Rapid microbial degradation and essentially no soil activity.

Unique Characteristics: Apply with SURE-MIX at 5 L/1,000 L of spray solution.

RIMSULFURON

Trade Name: ELIM SG (only available in the ENGARDE co-pack), ELIM EP (available only in BATTALION), PRISM SG.

Chemical Family: Sulfonylurea.

Crop and/or Non-Crop Registrations: ELIM EP – Field corn. Not for use on sweet or seed corn. PRISM – Highbush blueberries, caneberries (raspberries and blackberries), potatoes, transplanted processing tomatoes. Not for use on potatoes grown for seed.

Sensitive Weeds: Green foxtail, fall panicum, barnyard grass, redroot pigweed (incl. triazine-resistant), hairy nightshade, yellow foxtail (suppression), witchgrass, lamb's-quarters.

Uptake and Translocation: Following foliar application, rimsulfuron is rapidly absorbed through the leaves and translocated in both xylem and phloem.

Basis of Selectivity: Inhibition of acetolactate synthase (ALS) enzyme in susceptible plants leads to a rapid cessation of cell division and growth. Tolerant species rapidly convert rimsulfuron to non-phytotoxic metobolites.

Application Method: Postemergent, within the spike to 3 leaf stage of corn. Prior to initiation of flowering in potatoes.

Residual Activity: Provides season long control of labelled weeds to canopy closure.

Unique Characteristics: See nicosulfuron/rimsulfuron.

RIMSULFURON + S-METOLACHLOR + DICAMBA

Trade Name: BATTALION (co-pack of ELIM EP + DUAL II MAGNUM + BANVEL II).

Chemical Family: Sulfonylurea + Acetanilide + Benzoic acid.

Crop and/or Non-Crop Registrations: Corn.

Application Methods: Preemergence and postemergence up to the 3 leaf stage of corn.

For All Other Information: Refer to rimsulfuron, s-metolachlor and dicamba alone.

RIMSULFURON + MESOTRIONE

Trade Name: ENGARDE (co-pack of ENGARDE SG + MESOTRIONE SC).

Chemical Family: Sulfonylurea + Triketone.

Crop and/or Non-Crop Registrations: Corn.

Application Methods: Preemergence and postemergence up to the 3 leaf stage of corn.

For All Other Information: Refer to rimsulfuron, and mesotrione alone.

SAFLUFENACIL

Trade Names: ERAGON.

Chemical Family: Pyriminedione.

Crop and/or Non-Crop Registrations: Barley, corn (field and sweet), soybean and wheat. Dessicant in edible beans and soybean.

Sensitive Weeds: Canada fleabane, common ragweed, lamb's-quarters, redroot pigweed, stinkweed, velvetleaf, wild buckwheat, wild mustard and dandelion (suppression).

Uptake and Translocation: Emerged plants will take product up primarily by the foliage but sensitive non-emerged species will take up product through the roots and shoots. ERAGON is translocated mainly in the xylem and has limited mobility in the phloem.

Basis of Selectivity: Metabolized by tolerant species.

Application Methods: Preplant (soybean), preplant and preemergence (barley, wheat, corn and sweet corn), preharvest dessicant in edible beans and soybean.

Residual Activity: Dependent on rate, the 36–71 g/ha rate provides limited residual activity while the 107–143 g/ha rate provides much longer residual activity.

Unique Characteristics: Sensitive weed species will begin to show injury symptoms within hours and will typically die within 3 days, depending on environmental conditions. Any crop can be safely grown the year following applications of ERAGON at the 36 g/ha rate. A number of crops can be grown the year following applications of ERAGON at the high rate, refer to Tables 4–4 and 4–5, *Herbicide Crop Rotation and Soil pH Restrictions*, on page 74 and page 76, and the product label for more specific direction.

SAFLUFENACIL/DIMETHENAMID-P

Trade Names: INTEGRITY.

Chemical Family: Pyriminedione and chloroacetamide.

Crop and/or Non-Crop Registrations: Corn (field and sweet) and soybean.

Sensitive Weeds: Barnyard grass, crabgrass (smooth, large), eastern black nightshade, fall panicum, foxtails (green, yellow and giant), witchgrass, common ragweed, lamb's-quarters, redroot pigweed, velvetleaf, wild buckwheat, wild mustard and yellow nutsedge (PPI only). Refer to saflufenacil for other sensitive species.

Uptake and Translocation: Absorbed through shoots and roots of germinating grass and broadleaf weeds.

Basis of Selectivity: Unknown for dimethenamid-P, saflufenacil is metabolized by tolerant species.

Application Methods: Preplant incorporated and preemergence.

Residual Activity: Provides season-long weed control. Length of residual activity depends upon soil and moisture factors, application rate and timing. Heavy rainfall following an incorporated treatment may reduce weed control.

Unique Characteristics: A number of crops can be grown the year following applications of INTEGRITY, refer to Tables 4–4 and 4–5, *Herbicide Crop Rotation and Soil pH Restrictions*, on page 74 and page 76, and the product label for more specific direction.

SAFLUFENACIL/IMAZETHAPYR

Trade Names: OPTILL.

Chemical Family: Pyriminedione and imidazolinone.

Crop and/or Non-Crop Registrations: Soybean.

Sensitive Weeds: Barnyard grass, broadleaf plantain, Canada fleabane, common chickweed, common ragweed, crabgrass (large), dandelion (suppression), foxtail (green, yellow), lamb's-quarters, prickly lettuce, redroot pigweed, shepherd's-purse, stinkweed, velvetleaf, wild buckwheat and wild mustard.

For More Information: Refer to SAFLUFENACIL (page 66) and IMAZETHPYR (page 57)

S-METOLACHLOR

Trade Names: DUAL II MAGNUM.

Chemical Family: Acetanilide.

Crop and/or Non-Crop Registrations: Corn, soybeans, a number of different edible bean market classes, refer to Table 7–1. *Beans (Adzuki, Dry, Lima and Snap) Weed Control Ratings*, page 101 for specific crop registrations, transplanted cole crops (cabbage, cauliflower, broccoli), edamame, transplanted tomatoes, potatoes, sugar beets, processing peas, rutabagas and sweet white lupins, apples, apricots, cherries, peaches, pears and plums, highbush blueberries, carrots, cucumbers, melon crops, mustard greens, ornamentals, peppers, squash, strawberries and sweet potatoes.

Sensitive Weeds: Large and smooth crabgrass, witchgrass, barnyard grass, fall panicum, foxtails (green, yellow and giant), yellow nutsedge, American nightshade, eastern black nightshade and tall waterhemp.

Uptake and Translocation: Absorbed by germinating grasses mainly through the shoot just above seed. Absorbed by germinating broadleaf weeds through roots and shoots.

Basis of Selectivity: Metabolized by tolerant species.

Application Methods: Early preplant, preplant incorporated and preemergence. Early postemergence on corn (spike to 2 leaf stage of corn). Incorporation equipment should be set to work the soil 10 cm deep with a disc operating at 6–10 km/h or a vibrating shank cultivator at 10–13 km/h; 1 incorporation is sufficient and need not be immediate. Rainfall within 10 days is required for maximum activity of the preemergence application.

Residual Activity: Activity will normally be maintained for 10–14 weeks.

Unique Characteristics: The rate required depends on weed pressure (higher rate for heavier weed pressure). Yellow nutsedge control requires a preplant incorporated application. Winter cereals may be planted 4–5 months after metolachlor application. Many tank-mix combinations are registered on various crops. Do not use on muck soils or coarse-textured soils low in organic matter. DUAL II MAGNUM contains benoxacor, a chemical that enhances the corn plant's ability to metabolize s-metolachlor, thereby preventing corn injury even under adverse environmental conditions.

S-METOLACHLOR/ATRAZINE

Trade Name: PRIMEXTRA II MAGNUM.

Chemical Family: Acetanilide/s-triazine.

Crop and/or Non-Crop Registrations: Corn (ensilage, field, seed and sweet).

Sensitive Weeds: Germinating annual broadleaf weeds and annual grasses such as American nightshade, eastern black nightshade, lady's-thumb, lamb's-quarters, wild mustard, purslane, prostrate pigweed, redroot pigweed, wild buckwheat, smartweed, ragweed, crabgrass, barnyard grass, green foxtail, yellow foxtail, giant foxtail, witchgrass and fall panicum. Yellow nutsedge can be controlled with a preplant incorporated application.

Uptake and Translocation: Absorbed by germinating grasses mainly through shoot just above seed. Absorbed by germinating broadleaf weeds through roots and shoot.

Basis of Selectivity: Metabolized by tolerant species.

Application Methods: Early preplant, preplant incorporated, and preemergence. Early postemergence on corn (spike to 2 leaf stage of corn). Incorporation equipment should be set to work the soil 10 cm deep with a disc operating at 6–10 km/h or a vibrating shank cultivator at 10–13 km/h. One incorporation is sufficient and need not be immediate. Rainfall within 10 days is required for maximum activity of the preemergence application. S-metolachlor/atrazine may be applied in nitrogen solutions or liquid fertilizers for preplant incorporated or preemergence weed control. Dry bulk granular fertilizers may be impregnated with metolachlor/atrazine for preplant incorporation.

Residual Activity: Activity will normally be maintained for 10–14 weeks; late-germinating fall panicum will not be controlled. Soybeans, white beans, oats or barley may be planted the following spring.

Unique Characteristics: The rate required depends on weed pressure (higher rate for heavier weed pressure). Yellow nutsedge control requires a preplant incorporated application. Will not control triazine-resistant weed species. Contains atrazine in low amounts, which may carry over in a dry year. Is effective over a wide range of soil types and has a good margin of crop safety. Perennial weeds are not controlled. Primextra II MAGNUM contains benoxacor, a chemical that enhances the corn plant's ability to metabolize s-metolachlor, thereby preventing corn injury even under adverse environmental conditions.

S-METOLACHLOR/BENOXACOR/ METRIBUZIN

Trade Name: BOUNDARY LQD.

Chemical Family: Acetanilide/S-triazine.

Crop Registrations: Soybeans, tomato and potato.

Sensitive Weeds: Large and smooth crabgrass, witchgrass, barnyardgrass, fall panicum, giant, green and yellow foxtail, yellow nutsedge, American nightshade, Eastern black nightshade, redroot pigweed and tall waterhemp.

Uptake and Translocation: Absorbed by germinating grasses mainly through the shoot just above the seed. Broadleaf weed uptake is mainly through the roots but can also be through the shoots.

Basis of Selectivity: Metabolized by tolerant species.

Application Methods: Surface preplant, preplant incorporated and preemergence in soybeans; preplant incorporated in tomato and preemergence in potato. Rainfall within 10 days is required for maximum activity of the preemergence application.

Residual Activity: Activity will normally be maintained for 10–14 weeks depending upon use rate.

Unique Characteristics: The rate required depends on weed pressure (higher rate for heavier weed pressure). Yellow nutsedge control requires a preplant incorporated application. Do not use on muck soils or coarse textured soils low in organic matter. Do not use on potato varieties Belleisle, Tobique or Superior.

S-METOLACHLOR/BENOXACOR/ ATRAZINE/MESOTRIONE

Trade Name: LUMAX EZ.

Chemical Family: Acetanilide/S-triazine/triketone.

Crop Registrations: Field, seed and sweet corn.

Sensitive Weeds: Large and smooth crabgrass, witchgrass, barnyardgrass, fall panicum, giant, green and yellow foxtail, American nightshade, Eastern black nightshade, redroot common lamb's-quarters, common ragweed, redroot pigweed, velvetleaf, wild mustard, wild buckwheat and lady's thumb.

Uptake and Translocation: Absorbed by germinating grasses mainly through the shoot just above the seed. Broadleaf weed uptake is mainly through the roots but can also be through the shoots.

Basis of Selectivity: Metabolized by tolerant species.

Application Methods: Surface preplant (up to 7 days prior to planting), preemergence and early postemergence (up to and including the 2-leaf stage) in field corn. Apply only preemergence in seed and sweet corn. Rainfall within 10 days is required for maximum activity of the surface preplant and preemergence application.

Residual Activity: Activity will normally be maintained for 10–14 weeks. Late germinating fall panicum will not be controlled. Degradation is primarily by soil microbial action.

Unique Characteristics: Mesotrione applied with atrazine has a synergistic effect and improved control of broadleaf weed species. LUMAX EZ will control triazine tolerant weed species. LUMAX EZ contains benoxacor, a chemical that enhances the corn plant's ability to metabolize S-metolachlor, thereby preventing corn injury even under adverse environmental conditions.

SCLEROTINIA MINOR (STRAIN IMI 344141)

Trade Names: SARRITOR GRANULAR BIOLOGICAL HERBICIDE.

Crop and/or Non-Crop Registrations: Turfgrass.

Sensitive Weeds: Dandelion.

Uptake and Translocation: The active ingredient, Sclerotinia minor is a naturally occurring fungus that when applied to dandelion will grow into the weed and absorb plant tissue until the weed is controlled.

Application Methods: Postemergence. Apply when daytime high temperatures are 18–24°C and when rainfall occurs within 12 hours of application.

Residual Activity: Essentially none, will not control unemerged dandelion.

Unique Characteristics: SARRITOR will usually take between 5–7 days to suppress/control dandelion. This product will not affect grass species, but severe damage to non-target desirable broadleaf plant species may occur if SARRITOR comes in contact.

SETHOXYDIM

Trade Name: POAST ULTRA.

Chemical Family: Cyclohexanedione.

Crop and/or Non-Crop Registrations: Canola, flax, soybeans, a number of different edible bean market classes, refer to Table 7–1. *Beans (Adzuki, Dry, Lima and Snap) Weed Control Ratings*, page 101 for specific crop registrations peas, onions, tomatoes, potatoes, sweet potato, pumpkin, squash, cucumbers, alfalfa, buckwheat, creeping red fescue, garlic, broccoli, brussels sprouts, cabbage, cauliflower, chicory, peppermint, spearmint, snow peas, apples, apricots, cherries, peaches, pears, plums, highbush blueberries, cranberries, strawberries and sethoxydim-resistant corn.

Sensitive Weeds: Wild oats, foxtails, barnyard grass, large crabgrass, proso millet, fall panicum, witchgrass, volunteer corn and cereals and quackgrass.

Uptake and Translocation: Absorbed by foliage. Translocated upwards and downwards in plant.

Basis of Selectivity: Degraded by tolerant species (broadleaf plants).

Application Methods: Postemergence to actively growing annual grasses in the 1–6 leaf stage and quackgrass in the 1–3 leaf stage. Use flat fan nozzles and add MERGE adjuvant to the spray mix. Alternatively, ASSIST OIL CONCENTRATE or Ammonium sulphate plus ASSIST OIL CONCENTRATE may be used. Other postemergence herbicides not recommended as tank-mix combinations on the label must be applied at least 4 days before or after sethoxydim application. Aerial application is also registered.

Residual Activity: Essentially none. A second application and/or cultivation may be necessary to control grasses that emerge after treatment.

Unique Characteristics: Susceptible grasses, when sprayed, stop growing immediately and then gradually turn yellow to purple to brown over a period of 7–21 days, depending on growing conditions and crop competition. Rainfall within 1 hour after application may reduce effectiveness. If treated grasses are stressed (drought, flooding, prolonged cool temperatures) control will be delayed or reduced.

SIMAZINE

Trade Names: PRINCEP NINE-T, SIMADEX, SIMAZINE 480.

Chemical Family: S-triazine.

Crop and/or Non-Crop Registrations: Corn, established asparagus, bird's-foot trefoil, raspberries, loganberries, blackberries, highbush blueberries, alfalfa, apples, apricots, cherries, filberts, hazelnuts, peaches, pears and plums established for 1 year or more; grapes established for 3 or more years; shelterbelts established for at least one growing season (caragana, green ash, Siberian elm, American elm and Manitoba maple); new or established Christmas tree and woodland plantations (2 years or older white pine and balsam fir); woody ornamentals and nursery stock established for at least 1 year (cedar, barberry, apple, flowering crab apple, box wood, cotoneaster, dogwood, holly, rose, yews, chamaecyparis, hemlock, juniper, multiflora rose, peony; spruce, mugho pine, black walnut and white ash); nursery container stock (cedar, juniper, yew); aquatic weed control; non-cropland. Conifer site preparation before planting of fir, pine and spruce (Princep Nine-T only).

Sensitive Weeds: Annual broadleaf weeds such as pigweed, lady's-thumb, lamb's-quarters, purslane, ragweed, volunteer clover, wild buckwheat, smartweed, plantain and groundsel; annual grasses such as barnyard grass, crabgrass, wild oats and yellow foxtail (triazine-resistant biotypes of foxtail, lamb's-quarters, pigweed and groundsel will not be controlled); most perennial species starting freshly from seed.

Uptake and Translocation: Absorbed by roots; little or no foliar absorption; translocated upwards in xylem, accumulating in apical meristem and leaves with napropamide on new plantings of apples, apricot, cherries, plums, peaches and pears.

Basis of Selectivity: Some species, such as corn, metabolize simazine. In most crops, selectivity is based on the roots of the crop plants being deeper than the depth to which simazine leaches.

Application Methods: Preplant incorporated (to a depth of 2.5 cm) or preemergence in corn; preemergence in other crops. Broadcast or band application. In fruit crops, apply a 1 m wide band under the plants; cultivate or sod the area between the rows. For aquatic weed control, apply as a draw-down treatment or water-volume application in drainage ditches and ponds with no water flow-through.

Residual Activity: Soil residues may persist for more than 1 season. After spraying with simazine, do not plant any crop in the treated area in the same year except corn. Where rates in excess of 2 kg/ha have been applied, do not plant rotational crops in the following year; soils should be tested if there is any question of excessive residues remaining.

Unique Characteristics: Needs sufficient moisture to be activated. Should be applied only once per season. To avoid build-up of resistant weeds, simazine should be rotated with other non-triazine residual herbicides. Simazine is more persistent than atrazine. Where rainfall is sufficient to cause erosion, soil containing simazine may wash to lower areas of land and injure existing or subsequent crops.

SULFENTRAZONE

Trade Name: AUTHORITY 480.

Chemical Family: Dicarboxamide.

Crop and/or Non-Crop Registrations: Chickpeas, field peas, flax, sunflower and soybean.

Sensitive Weeds: wild buckwheat, kochia, lamb’s-quarters and redroot pigweed.

Uptake and Translocation: Primarily taken up by the roots of treated plants following soil applications. Movement in the phloem is limited because of the rapid foliar desiccation caused by the herbicide.

Application Methods: Pre-plant or preemergence up to 3 days after planting.

Residual Activity: Provides about 4–6 weeks of residual weed control for sensitive species.

Unique characteristics: Will not control emerged weed species.

SURFACTANT

See Chapter 5, *Notes on Adjuvants*, page 81.

TEMBOTRIONE/THIENCARBAZONE-METHYL

Trade Names: VIOS G3.

Chemical Family: Triketone/sulfonylaminocarbonyltriazolinones.

Crop and/or Non-Crop Registrations: Glyphosate tolerant (“Roundup Ready”) or Glufosinate-ammonium tolerant (“Liberty Link”) corn only.

Sensitive Weeds: Emerged annual grass and broadleaf weeds controlled by glyphosate or Liberty herbicide and residual control of weeds specified in Table 9–6. *Glyphosate Tolerant (“Roundup Ready”) Corn Herbicide Weed Control Ratings*, page 156

Uptake and Translocation: Tembotrione – foliar uptake, Thiencarbazone-methyl – foliar and soil uptake.

Basis of Selectivity: Metabolism by tolerant species.

Application Methods: Postemergence from the 1–6 leaf stage of “Roundup Ready” or “Liberty Link” field corn.

Residual Activity: VIOS G3 will provide residual control of lamb’s-quarters, redroot pigweed, wild buckwheat, lady’s thumb, wild mustard, common hempnettle, common chickweed, spiny annual sowthistle, common ragweed, velvetleaf, eastern black nightshade, green foxtail, yellow foxtail, barnyard grass, witchgrass and large crabgrass.

Unique Characteristics: VIOS G3 has a very low use rate and convenient packaging. It must always be tank-mixed with either glyphosate or LIBERTY 200SN.

TERBACIL

Trade Name: SINBAR, SINBAR WDG.

Chemical Family: Uracil.

Crop and/or Non-Crop Registrations: Asparagus. Apples, apricots, cherries, highbush blueberries, peaches, pears, plums, spearmint, peppermint, raspberries and strawberries; with napropamide on new plantings of apples, apricots, cherries, plums, peaches and pears.

Sensitive Weeds: Barnyard grass, bluegrass, crabgrass, foxtail, chickweed, cheat grass, perennial rye grass, wild barley, mustard, prickly lettuce, stinkweed, annual sow-thistle, henbit, lamb’s-quarters, pigweed, purslane and ragweed. Partial control of quackgrass, horsenettle, vetch and yellow nutsedge.

Uptake and Translocation: Uptake is mostly through roots, although partially through foliage and stem. Translocation is upward into leaves.

Basis of Selectivity: Used only on established plantings so that roots of crop are below depth to which chemical penetrates. May also be slower translocation and faster degradation in tolerant species.

Application Methods: Apply to the soil surface in 200–1,000 L water/ha. If weed growth is present in apples, paraquat may be mixed with spray. Rates for strawberries are considerably lower and can be applied in spring, postharvest or late fall. Control of perennial grasses may be improved by cultivation prior to treatment.

Residual Activity: May be up to 2 years. Residues are likely to be higher on heavier soil types if higher rates and repeated applications are used.

Unique Characteristics: Moisture is necessary to activate the chemical within 2 weeks after application. Do not apply on soils with less than 1% organic matter, nor on eroded soil areas. Use lower rates on soils with 1–2% organic matter. Do not apply on weak or diseased strawberry plants.

THIFENSULFURON-METHYL

Trade Name: PINNACLE SG.

Chemical Family: Sulfonyl urea.

Crop and/or Non-Crop Registrations: Soybeans, tomatoes.

Sensitive Weeds: Redroot pigweed, lamb's-quarters, velvetleaf, lady's-thumb and wild mustard.

Uptake and Translocation: Following foliar application, the herbicide is rapidly absorbed and translocated in both the xylem and phloem to growing points of sensitive weeds.

Basis of Selectivity: Inhibition of acetolactase synthase (ALS) enzyme in susceptible plants that leads to a rapid cessation of cell division and plant growth. Tolerant species rapidly metabolize the herbicide into non-phytotoxic metabolites.

Application Method: Postemergence.

Residual Activity: Rapid soil microbial degradation. Half-life of 5 days at 25°C soil temperatures.

Unique Characteristics: Labelled species can be controlled up to 10 cm in height. Redroot pigweed is very sensitive. Typical symptoms of plant death (leaf crinkling, curling, chlorosis) occur 5–10 days after application depending on the growing conditions. Inclusion of either a non-ionic surfactant at 0.1% v/v or a crop oil concentrate at 0.5% v/v is required for weed control. Velvetleaf control is greatly enhanced by the inclusion of an ammonium containing fertilizer (such as a UAN solution).

THIFENSULFURON-METHYL/ TRIBENURON-METHYL

Trade Name: REFINE SG. REFINE M (co-pack of REFINE SG + MCPA) BOOST M (co-pack of BOOST + MCPA Ester).

Chemical Family: Sulfonyl urea.

Crop and/or Non-Crop Registrations: Wheat (spring, winter, Durum), barley, oats not underseeded to legumes or grasses. Refine SG can be applied to winter wheat in the fall or the spring.Sensitive Weeds: Lamb's-quarters, annual smartweed (green smartweed, lady's-thumb), chickweed, hemp-nettle, wild buckwheat, cow cockle, stinkweed, Canada thistle, sow-thistle, round-leaved mallow.

Uptake and Translocation: Following foliar application, is rapidly absorbed and translocated in both xylem and phloem.

Basis of Selectivity: Inhibition of acetolactate synthase in susceptible plants leads to a rapid cessation of cell division and growth. Tolerant species rapidly convert to non-phytotoxic metabolites.

Application Method: Postemergence.

Residual Activity: Rapid soil microbial degradation.

Unique Characteristics: A non-ionic surfactant must be added. Typical symptoms of plant death (leaf crinkling, curling, chlorosis) occur 5–10 days after application depending on growing conditions. Tank-mixes with MCPA and 2,4-D for control of ragweed and mustards.

TOPRAMEZONE

Trade Name: IMPACT, ARMEZON.

Chemical Family: Pyrazolone.

Crop and/or Non-Crop Registrations: Corn (field, seed and sweet).

Sensitive Weeds: Annual broadleaf and grassy weeds, including triazine and group 2 resistant biotypes.

Basis of Selectivity: Inhibits the HPPD enzyme found in photosynthetic cells of susceptible species. Symptoms on susceptible plants are bleaching followed by necrosis. Tolerant species rapidly metabolize topramezone.

Application Methods: Postemergence in field corn between the 1–8 leaf stage for broadleaf weeds and 1–4 leaf stage of grassy weeds.

Residual Activity: Degradation primarily by soil microbial action. Topramezone provides soil residual activity against broadleaf weeds.

Unique Characteristics: The activity of topramezone is significantly enhanced by atrazine. A tank mix of Topramezone with atrazine and dimethenamid-P provides a one-pass, postemergence weed control program with residual activity against grass and broadleaf weeds.

TRALKOXYDIM

Trade Name: ACHIEVE LIQUID.

Chemical Family: Cyclohexanedione.

Crop and/or Non-Crop Registrations: Wheat (Durum, spring and winter), spring barley, rye (spring and winter), triticale. crested wheatgrass, creeping red fescue, meadow and smooth bromegrass, northern wheatgrass, slender wheatgrass and western wheatgrass.

Sensitive Weeds: Wild oats, volunteer oats, green and yellow foxtail.

Uptake and Translocation: Uptake through the leaves, translocated to growing points of roots, shoots and leaves.

Basis of Selectivity: Metabolized in tolerant species.

Application Methods: Postemergence to actively growing wild oats at 1–5 leaf stage. Rainfast in 1 hour.

Residual Activity: None.

Unique Characteristics: Safe on all varieties of spring wheat and barley. May be applied to cereal crops underseeded to legumes such as clover, alfalfa, sainfoil or bird's-foot trefoil. Do not feed or graze forage in year of treatment.

TRICLOPYR

Trade Name: GARLON 4, GARLON ULTRA, GARLON XRT, GARLON RTU, RELEASE.

Chemical Family: Pyridine.

Non-Crop Registrations: GARLON 4 – Site preparation for lowbush blueberry, nursery stock and the control of unwanted woody plants and annual and perennial broadleaf weeds in non-crop areas including rights-of-way, electrical power lines, communication lines, pipelines, roadsides and manufacturing and storage sites. RELEASE silvicultural herbicide controls undesirable woody plants and annual and perennial broadleaf weeds in woodland management.

Sensitive Weeds: Woody plant species controlled are: alder, ash, aspen, basswood, beech, birch, blackberry, raspberry, buckthorn, cottonwood, dogwood, elderberry, hawthorn, hickory, hop-hornbeam, locust, maples, mulberry, poison-oak, poplar, sumac, willow, honey locust, choke cherry, elm, red maple, oaks and pines. Annual and broadleaf weeds controlled are: burdock, chicory, curled dock, dandelion, field bindweed, lamb's-quarters, ragweed, smartweed, smooth bedstraw, vetch and wild lettuce.

Uptake and Translocation: Triclopyr is absorbed by both plant leaves and roots. It is readily translocated through plants. It tends to accumulate in meristematic tissues and is not readily metabolized in susceptible plants.

Basis of Selectivity: Tolerant species such as grasses rapidly metabolize triclopyr.

Application Methods: For deciduous and certain conifer species use as a foliage spray when brush species are actively growing. Apply either broadcast using a fixed nozzle (constant volume per ha) or selectively using a spray gun (variable volume per ha). As spray gun applications use a dilute spray mix, this type of application must thoroughly wet the foliage, stem and root collar. Brush should be treated after foliage is well developed and actively growing. For conifer release in woodland sites, apply in late summer after conifers have hardened off and deciduous trees are in full leaf but prior to autumn colouration. Woody plants may also be controlled by using basal bark, dormant stem and cut-surface treatments.

Residual Activity: Half-life in soil is approximately 30 days under conditions that are favourable for microbial decomposition.

Unique Characteristics: Apply only when there is little or no hazard from spray drift. Small quantities of spray drift may injure susceptible broadleaf plants.

TRIFLURALIN

Trade Names: BONANZA 480, RIVAL, TREFLAN EC.

Chemical Family: Dinitroaniline.

Crop and/or Non-Crop Registrations: Soybeans, winter wheat, black, kidney, lima, snap and white beans, faba beans, snap beans, lima beans, black beans, canola forage kale, sunflowers, turnips, peas (field and canning), mustard, direct-seeded alfalfa; transplants of tomatoes, peppers, Brussels sprouts, broccoli, cabbage and cauliflower; carrots, crambe, direct-seeded cabbage and cauliflower, annual flowers, woody ornamental plantings and field-grown nursery stock, perennials, established shelterbelts, strawberries.

Sensitive Weeds: Most annual grasses, pigweed and lamb's-quarters, including the triazine-tolerant biotypes.

Uptake and Translocation: No significant absorption or translocation of trifluralin in crops grown in soil treated with trifluralin. Susceptible weeds are controlled as they germinate. Established weeds are not controlled.

Basis of Selectivity: Physiological growth processes associated with seed germination.

Application Methods: Preplant incorporated. Apply in 100–300 L of water/ha. Use lower rate of the chemical on sandy soils and increased rate for loam-to-clay soils. Do not use on highly organic soils (muck, peat or black sands above 15% organic matter). Incorporate twice in cross directions using a tandem disc (7–10 km/h) or tine cultivator (10–13 km/h) set to work 8–10 cm deep. The first incorporation should be done as soon as possible after application, but may be delayed 8–24 hours, depending on label directions. The second incorporation should take place anytime before planting. Activated upon incorporation; rainfall is not required.

Residual Activity: Labelled application rates provide season-long weed control. Succeeding crops, even fall-seeded grain crops planted in soil that received trifluralin the preceding spring, will not be injured under normal conditions.

Unique Characteristics: Strongly adsorbed to soil particles and shows negligible leaching. Organic matter and clay content influence application rate. Does not control ragweed, annual nightshades or mustards; lady's-thumb may escape.

TRIFLUSULFURON-METHYL

Trade Name: UPBEET.

Chemical Family: Sulfonylurea.

Crop and/or Non Crop Registrations: Sugar beets, chicory and red beets. With BETAMIX B on sugar beets.

Sensitive Weeds: Redroot and green pigweed, velvetleaf.

Uptake And Translocation: Following foliar application, the herbicide is rapidly absorbed and translocated in both the xylem and phloem to growing points of sensitive weeds.

Basis of Selectivity: Inhibition of acetolactase synthase (ALS) enzyme in susceptible plants that leads to a rapid cessation of cell division and plant growth. Tolerant species rapidly metabolize the herbicide into non-phytotoxic metabolites.

Application Methods: Postemergence.

Residual Activity: None.

Unique Characteristics: Must be applied with an approved adjuvant system including 0.2% v/v non-ionic surfactant. Addition of 28% urea ammonium nitrate (U.A.N.) at 2 L/ha will improve weed control. Plant death of target weeds may take from 1–3 weeks for visual symptoms to develop. Symptoms develop more quickly under favourable growing conditions.

TABLE 4–3. Glyphosate Products, Registered Uses and Rates Needed to Control Specific Weed Species in Glyphosate Tolerant Crops

LEGEND: ✓ = registered for use on glyphosate tolerant canola, corn, soybeans and sugarbeets x = not indicated for use on this crop

		GLYPHOSATE TOLERANT CROPS				**WEED SPECIFIC GLYPHOSATE PRODUCT RATES (L/acre)[1] IN GLYPHOSATE TOLERANT CORN, SOYBEAN AND SUGARBEETS**									
Trade Name	**Concentration**	**Canola**	**Field Corn**	**Soybean**	**Sugarbeets**	**Annual Weeds**	**Alfalfa (Volunteer)**	**Dandelions (>15 cm)**	**Canada Thistle**	**Field Bindweed**	**Horse Nettle**	**Yellow Nutsedge**	**Perennial Sow-thistle**	**Wire-stemmed Muhly**	**Quackgrass (3–4 leaf)**
CREDIT XTREME	540 g/L	✓	✓	✓	x	1.67 L/ha 0.67 L/acre	4.68 L/ha 1.87	3.33 L/ha 1.34 L/acre	1.67 L/ha 0.67 L/acre	3.33 L/ha 1.34 L/acre	3.33 L/ha 1.34 L/acre	3.33 L/ha 1.34 L/acre	1.67 L/ha 0.67 L/acre	1.67 L/ha 0.67 L/acre	1.67 L/ha 0.67 L/acre
FACTOR	356 g/L	✓	✓	✓	x	2.5 L/ha 1 L/acre	7 L/ha 2.8 L/acre	5 L/ha 2 L/acre	2.5 L/ha 1 L/acre	5 L/ha 2 L/acre	5 L/ha 2 L/acre	2 5 L/ha 2 L/acre	2.5 L/ha 1 L/acre	2.5 L/ha 1 L/acre	2.5 L/ha 1 L/acre
FACTOR 540	540 g/L	✓	✓	✓	x	1.67 L/ha 0.67 L/acre	4.68 L/ha 1.87 L/acre	3.33 L/ha 1.34 L/acre	1.67 L/ha 0.67 L/acre	3.33 L/ha 1.34 L/acre	3.33 L/ha 1.34 L/acre	3.33 L/ha 1.34 L/acre	1.67 L/ha 0.67 L/acre	1.67 L/ha 0.67 L/acre	1.67 L/ha 0.67 L/acre
GLYFOS	356 g/L	✓	x	✓	x	2.5 L/ha 1 L/acre	7 L/ha 2.8 L/acre	5 L/ha 2 L/acre	2.5 L/ha 1 L/acre	5 L/ha 2 L/acre	5 L/ha 2 L/acre	5 L/ha 2 L/acre	2.5 L/ha 1 L/acre	2.5 L/ha 1 L/acre	2.5 L/ha 1 L/acre
MATRIX	480 g/L	✓	✓	✓	x	1.87 L/ha 0.75 L/acre	5.25 L/ha 2.1 L/acre	3.75 L/ha 1.5 L/acre	1.87 L/ha 0.75 L/acre	3.75 L/ha 1.5 L/acre	3.75 L/ha 1.5 L/acre	3.75 L/ha 1.5 L/acre	1.87 L/ha 0.75 L/acre	1.87 L/ha 0.75 L/acre	1.87 L/ha 0.75 L/acre
MAVERICK III	480 g/L	✓	✓	✓	x	1.87 L/ha 0.75 L/acre	5.25 L/ha 2.1 L/acre	3.75 L/ha 1.5 L/acre	1.87 L/ha 0.75 L/acre	3.75 L/ha 1.5 L/acre	3.75 L/ha 1.5 L/acre	3.75 L/ha 1.5 L/acre	1.87 L/ha 0.75 L/acre	1.87 L/ha 0.75 L/acre	1.87 L/ha 0.75 L/acre
POLARIS	360 g/L	✓	✓	✓	x	2.5 L/ha 1 L/acre	7 L/ha 2.8 L/acre	5 L/ha 2 L/acre	2.5 L/ha 1 L/acre	5 L/ha 2 L/acre	5 L/ha 2 L/acre	5 L/ha 2 L/acre	2.5 L/ha 1 L/acre	2.5 L/ha 1 L/acre	2.5 L/ha 1 L/acre
ROUNDUP ULTRA2	540 g/L	✓	✓	✓	✓	1.67 L/ha 0.67 L/acre	4.68 L/ha 1.87 L/acre	3.33 L/ha 1.34 L/acre	1.67 L/ha 0.67 L/acre	3.33 L/ha 1.34 L/acre	3.33 L/ha 1.34 L/acre	3.33 L/ha 1.34 L/acre	1.67 L/ha 0.67 L/acre	1.67 L/ha 0.67 L/acre	1.67 L/ha 0.67 L/acre
ROUNDUP WEATHERMAX	540 g/L	✓	✓	✓	✓	1.67 L/ha 0.67 L/acre	4.68 L/ha 1.87 L/acre	3.33 L/ha 1.34 L/acre	1.67 L/ha 0.67 L/acre	3.33 L/ha 1.34 L/acre	3.33 L/ha 1.34 L/acre	3.33 L/ha 1.34 L/acre	1.67 L/ha 0.67 L/acre	1.67 L/ha 0.67 L/acre	1.67 L/ha 0.67 L/acre
SHARPSHOOTER	356 g/L	✓	✓	✓	x	2.5 L/ha 1 L/acre	7 L/ha 2.8 L/acre	5 L/ha 2 L/acre	2.5 L/ha 1 L/acre	5 L/ha 2 L/acre	5 L/ha 2 L/acre	5 L/ha 2 L/acre	2.5 L/ha 1 L/acre	2.5 L/ha 1 L/acre	2.5 L/ha 1 L/acre
SHARPSHOOTER PLUS	360 g/L	✓	✓	✓	x	2.5 L/ha 1 L/acre	7 L/ha 2.8 L/acre	5 L/ha 2 L/acre	2.5 L/ha 1 L/acre	5 L/ha 2 L/acre	5 L/ha 2 L/acre	5 L/ha 2 L/acre	2.5 L/ha 1 L/acre	2.5 L/ha 1 L/acre	2.5 L/ha 1 L/acre
TOUCHDOWN TOTAL	500 g/L	✓	✓	✓	x	1.8 L/ha 0.72 L/acre	5 L/ha 2 L/acre	3.6 L/ha 1.44 L/acre	1.8 L/ha 0.72 L/acre	3.6 L/ha 1.44 L/acre	3.6 L/ha 1.44 L/acre	3.6 L/ha 1.44 L/acre	1.8 L/ha 0.72 L/acre	1.8 L/ha 0.72 L/acre	1.8 L/ha 0.72 L/acre

[1] The maximum rate of glyphosate that can be used on glyphosate (540 g/L) tolerant Canola is 0.5 L/acre. Refer to the glyphosate tolerant Canola section in Chapter 12, page 246 for weeds that are sensitive at that rate.

TABLE 4–3. Glyphosate Products, Registered Uses and Rates Needed to Control Specific Weed Species in Glyphosate Tolerant Crops

LEGEND: ✓ = registered for use on glyphosate tolerant canola, corn, soybeans and sugarbeets x = not indicated for use on this crop

		GLYPHOSATE TOLERANT CROPS				WEED SPECIFIC GLYPHOSATE PRODUCT RATES (L/acre)[1] IN GLYPHOSATE TOLERANT CORN, SOYBEAN AND SUGARBEETS									
Trade Name	**Concentration**	**Canola**	**Field Corn**	**Soybean**	**Sugarbeets**	**Annual Weeds**	**Alfalfa (Volunteer)**	**Dandelions (>15 cm)**	**Canada Thistle**	**Field Bindweed**	**Horse Nettle**	**Yellow Nutsedge**	**Perennial Sow-thistle**	**Wire-stemmed Muhly**	**Quackgrass (3–4 leaf)**
VANTAGE PLUS MAX II	480 g/L	✓	✓	✓	x	1.87 L/ha 0.75 L/acre	5.25 L/ha 2.1 L/acre	3.75 L/ha 1.5 L/acre	1.87 L/ha 0.75 L/acre	3.75 L/ha 1.5 L/acre	3.75 L/ha 1.5 L/acre	3.75 L/ha 1.5 L/acre	1.87 L/ha 0.75 L/acre	1.87 L/ha 0.75 L/acre	1.87 L/ha 0.75 L/acre

[1] The maximum rate of glyphosate that can be used on glyphosate (540 g/L) tolerant Canola is 0.5 L/acre. Refer to the glyphosate tolerant Canola section in Chapter 12, page 246 for weeds that are sensitive at that rate.

TABLE 4–4. Herbicide Crop Rotation and Soil pH Restrictions – Field Crops

LEGEND: ✓ = Registered for application on this crop f = Field bioassay; user assumes liability for all crops not indicated on the label.
* = re-crop restriction (in months) is listed on the product label. (Other numbers based on the best available information. Contact the manufacturer of the specified product for more information.)
** sold as a co-pack under this trade name.

	Field Crops (for other crops, consult the label)																						
	Alfalfa	Barley	Barley (Underseeded)	Beans, Kidney	Beans, White	Canola	Canola, (PURSUIT tolerant)	Clover, Red	Corn, Field	Corn, Seed	Flax – Linseed	Oats	Oats (Underseeded)	Peanuts	Rye, Fall	Rye, Fall (Underseeded)	Soybeans	Sunflowers	Tobacco	Wheat, Spring	Wheat, Spring (Underseeded)	Wheat, Winter	Wheat, Winter (with red clover)
Trade Name	**Number of months between application and planting**																						
ACCENT	10*	10*	10*	f	10*	10*	10*	10*	✓	f	f	f	f	f	f	f	10*	f	f	f	f	4*	10*
ACCENT TOTAL[1]	10*	10*	10*	f	10*	10*	10*	10*	✓	f	f	f	f	f	f	f	10*	f	f	f	f	4*	f
ATRAZINE <1.0 kg ai/ha	10	10	10	10	10	22	22	10	✓	✓	10	10	10	22	10	10	10	22	22	10	10	4	10
ATRAZINE > 1.0–1.5 kg ai/ha	22	10	22	22	22	22	22	22	✓	✓	10	22	22	22	10	22	10	22	22	10	22	10	22
AUTHORITY	12	12	12	f	f	12	12	f	12	24	✓	f	f	f	f	f	✓	✓	f	12	12	4	4
BATTALION**	f	10*	f	f	10*	10*	10*	10*	✓	f	f	f	f	f	f	f	10*	f	f	f	f	4*	10*
BROADSTRIKE RC (Soil pH >7.8 and OM <2%)	10	10*	f	10*	10*	26	26	10	10*	10*	f	f	f	f	f	f	✓	f	f	10*	f	4*	f
CALLISTO/LUMAX	11*	10	f	f	11*	f	f	22	✓	✓	f	10	f	f	4	f	11*	f	f	10*	f	4*	f
CHATEAU	11*	11*	11*	9*	9*	9*	9*	f	9*	9*	f	f	f	f	f	f	✓	9*	f	8*	11*	4*	f
CLASSIC/CHAPERONE (Soil pH 7.4 and less)	10*	10*	f	f	10*	f	f	f	10*	f	f	f	f	f	f	f	✓	f	f	f	f	3*	f
CLASSIC/CHAPERONE (Soil pH 7.4–7.8)	22	22	f	f	22	f	f	f	10*	f	f	f	f	f	f	f	✓	f	f	f	f	4*	f
CLASSIC/CHAPERONE (Soil pH 7.8–8.0)	22	22	f	f	22	f	f	f	22	f	f	f	f	f	f	f	✓	f	f	f	f	4*	f
CLEAN SWEEP**	10	10	22	10	10	22	10	22	10	22	22	22	22	22	22	22	✓	22	22	10	22	3.3*	22
COMMAND 360 ME	16	16	16	10	10	10	10	16	10	10	16	16	16	16	16	16	✓	16	16	16	16	16*	16*
CONQUEST LQ**	22	10	22	22	22	22	22	22	10*	22	22	22	22	22	22	22	✓	22	22	10*	22	4*	22
CONVERGE XT**	10*	10*	f	f	f	10*	10*	f	✓	10*	f	10*	f	f	f	f	10*	f	f	10*	f	4*	f
FIRSTRATE	9*	f	f	9*	9*	26*	26*	f	9*	f	f	f	f	9*	f	f	✓	30*	30*	f	f	4*	f
INFINITY	10*	✓	f	f	f	10*	10*	f	10*	f	10*	10*	10*	f	f	f	10*	f	f	✓	f	✓	f
INTEGRITY	11*	4*	11*	11*	11*	11*	11*	11*	✓	11*	11*	4*	11*	11*	4*	11*	11*	11*	11*	4*	11*	4*	11*
IMPACT or ARMEZON	f	f	f	f	10*	f	f	f	✓	f	f	f	f	f	f	f	10*	f	f	10*	f	4*	f

TABLE 4–4. Herbicide Crop Rotation and Soil pH Restrictions – Field Crops (cont'd)

LEGEND: ✓ = Registered for application on this crop f = Field bioassay; user assumes liability for all crops not indicated on the label.
* = re-crop restriction (in months) is listed on the product label. (Other numbers based on the best available information. Contact the manufacturer of the specified product for more information.)
** sold as a co-pack under this trade name.

	Field Crops (for other crops, consult the label)																						
	Alfalfa	Barley	Barley (Underseeded)	Beans, Kidney	Beans, White	Canola	Canola, (PURSUIT tolerant)	Clover, Red	Corn, Field	Corn, Seed	Flax – Linseed	Oats	Oats (Underseeded)	Peanuts	Rye, Fall	Rye, Fall (Underseeded)	Soybeans	Sunflowers	Tobacco	Wheat, Spring	Wheat, Spring (Underseeded)	Wheat, Winter	Wheat, Winter (with red clover)
Trade Name	**Number of months between application and planting**																						
LONTREL	22	10*	22	22	22	✓	✓	22	10	22	10*	10*	22	22	10	22	22	22	22	10*	22	10*	22
MILESTONE	48	10	10	48	48	10	10	48	10	10	10	10	10	10	f	10	48	48	48	10	10	10	10
MUSTER	22*	10*	f	f	22*	✓	✓	22*	f	f	10*	10*	f	f	f	f	10*	f	f	10	f	4	f
OPTILL	10	10	22	10	10	22	10	22	10	22	22	22	22	22	22	22	✓	22	22	10	22	3.3	22
OPTION 2.25 OD	10	10	10	10	10	10	10	10	✓	f	f	10*	10	f	f	f	10*	f	f	10*	10	4*	10*
PEAK	22*	10*	f	f	10*	f	f	f	✓	f	f	10*	f	f	f	f	10*	f	f	f	f	f	f
PURSUIT/PHANTOM/NU-IMAGE	✓	10	22	✓	✓	22	✓	22	10*	22	22	22	22	22	22	22	✓	22	22	10	22	3.3*	22
PRISM	f	10*	f	f	10*	10	10	10*	✓	f	f	f	f	f	f	f	10*	f	f	f	f	4*	10*
REFLEX	f	f	f	✓	✓	18*	18*	f	10*	f	f	f	f	f	f	f	✓	f	f	10*	f	4*	f
SENCOR (Soil pH > 7.5)	10*	10	10	10	10	22	22	10	✓	10	10	10	10	10	10	10	✓	10	22	10	10	3.3	10
SIMAZINE/PRINCEP <2 kg ai/ha	✓	10	10	22	22	22	22	22	✓	10	22	10	10	10	10	10	22	22	22	10	10	10	10
SIMAZINE/PRINCEP >2 kg ai/ha	✓	22	22	22	22	22	22	22	✓	22	22	22	22	22	22	22	22	22	22	22	22	22	22
ULTIM	f	10*	f	f	10*	10*	10*	10*	✓	f	f	f	f	f	f	f	10*	f	f	f	f	4*	f
ULTIM TOTAL**	f	10*	f	f	10*	10*	10*	10*	✓	f	f	f	f	f	f	f	10*	f	f	f	f	4*	f
VALTERA	11*	11*	11*	9*	9*	9*	9*	f	9*	9*	f	f	f	f	f	f	✓	9*	f	8*	11*	4*	f
VIOS G3	f	f	f	f	f	f	f	f	✓	f	f	f	f	f	f	f	10*	f	f	f	f	4*	f

TABLE 4–5. Herbicide Crop Rotation and Soil pH Restrictions – Horticultural Crops

LEGEND: ✓ = Registered for application on this crop f = Field bioassay; user assumes liability for all crops not indicated on the label.
* = re-crop restriction (in months) is listed on the product label. (Other numbers based on the best available information. Contact the manufacturer of the specified product for more information.)
** sold as a co-pack under this trade name.

	Horticultural Crops (for other crops, consult the label).																											
	Asparagus	**Beans, Lima**	**Beans, Snap**	**Beets, Red**	**Beets, Sugar**	**Broccoli**	**Brussels Sprouts**	**Cabbage**	**Carrots**	**Cauliflower**	**Celery**	**Corn, Sweet**	**Cucumber**	**Garlic**	**Herbs**	**Lettuce**	**Muskmelon**	**Onions**	**Parsnips**	**Peas**	**Peppers**	**Potatoes**	**Pumpkin**	**Rutabaga**	**Spinach**	**Squash**	**Tomatoes (Transplanted)**	**Watermelon**
Trade Name	**Number of months between application and planting**																											
ACCENT	f	f	f	f	f	f	f	10	f	f	f	✓	f	f	f	f	f	f	f	f	f	10	f	f	f	f	10	f
ACCENT TOTAL**	f	f	f	f	f	f	f	10	f	f	f	f	f	f	f	f	f	f	f	f	f	10	f	f	f	f	10	f
ATRAZINE <1.0 kg ai/ha	22	10	10	22	22	22	22	22	22	22	22	✓	22	22	22	22	22	22	22	10	22	10	22	22	22	22	10	22
ATRAZINE >1.0–1.5 kg ai/ha	22	22	22	22	22	22	22	22	22	22	22	✓	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
BATTALION**	f	f	f	f	10	f	f	f	f	f	f	10	f	f	f	f	f	f	f	f	f	10	f	f	f	f	10	f
BROADSTRIKE DUAL MAGNUM (Soil pH >7.8 and OM <2%)	f	10*	10*	f	f	f	f	f	f	f	f	22	22	f	f	f	f	f	f	10*	22	22	f	f	f	f	26	f
CALLISTO	f	22	22	f	f	f	f	f	f	f	f	✓	f	f	f	f	f	f	f	22	f	11	f	f	f	f	11	f
CHATEAU	✓	9*	9*	f	f	f	f	f	f	f	f	f	f	f	f	f	f	✓	f	f	f	✓	f	f	f	f	f	f
CLASSIC/CHAPERONE (Soil pH 7.0 and less)	f	f	f	f	f	f	f	11	f	f	f	11	f	f	f	f	f	f	f	11	f	f	f	f	f	f	12	f
CLASSIC/CHAPERONE (Soil pH 7.0 to 8.0)	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	12	f
CLEAN SWEEP**	22	22	22	f	f	22	22	22	22	22	22	22	22	22	22	22	22	22	22	✓	22	22	22	22	22	22	22	22
COMMAND 360 ME	16	16	10	16	16	10	16	16	16	16	16	10	✓	16	16	16	16	16	16	10	✓	10	✓	16	16	10	16	16
CONQUEST LQ**	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
CONVERGE XT**	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	10	f	12*	f	f	f	f	12*	f
FIRSTRATE	f	f	9	9	f	f	f	f	f	f	f	18	f	f	f	f	f	f	f	9	f	f	f	f	f	f	f	f
INFINITY	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f
INTEGRITY	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11	11
IMPACT or ARMEZON	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f
LONTREL	22	22	22	22	✓	✓	22	✓	22	✓	22	22	22	22	22	22	22	22	22	22	22	22	22	✓	22	22	22	22
MILESTONE	f	48	48	f	f	f	f	f	f	f	f	10	f	f	f	f	f	f	f	48	48	f	f	f	f	f	48	f

TABLE 4–5. Herbicide Crop Rotation and Soil pH Restrictions – Horticultural Crops (cont'd)

LEGEND: ✓ = Registered for application on this crop f = Field bioassay; user assumes liability for all crops not indicated on the label.
* = re-crop restriction (in months) is listed on the product label. (Other numbers based on the best available information. Contact the manufacturer of the specified product for more information.)
** sold as a co-pack under this trade name.

	Horticultural Crops (For other crops, consult the label).																											
Trade Name	**Asparagus**	**Beans, Lima**	**Beans, Snap**	**Beets, Red**	**Beets, Sugar**	**Broccoli**	**Brussels Sprouts**	**Cabbage**	**Carrots**	**Cauliflower**	**Celery**	**Corn, Sweet**	**Cucumber**	**Garlic**	**Herbs**	**Lettuce**	**Muskmelon**	**Onions**	**Parsnips**	**Peas**	**Peppers**	**Potatoes**	**Pumpkin**	**Rutabaga**	**Spinach**	**Squash**	**Tomatoes (Transplanted)**	**Watermelon**
	Number of months between application and planting																											
MUSTER	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	✓	f	f	f	f
OPTION 2.25 OD	f	f	f	f	10*	f	10	10*	f	f	f	10*	f	f	f	f	f	f	f	10*	f	10*	f	f	f	f	f	f
PEAK	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	10*	f	f	f	f	f	f	f	f
PRISM	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	✓	f	f	f	f	✓	f
PURSUIT/PHANTOM/NU-IMAGE	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	✓	22	22	22	22	22	22	22	22
REFLEX	f	f	✓	18	18	18	18	18	f	18	f	18	✓	f	f	f	f	f	f	f	f	f	f	18	f	f	f	f
SENCOR (Soil pH > 7.5)	✓	10	10	22	22	22	22	22	10	22	22	10	22	10	10	22	22	22	10	10	22	✓	22	22	22	22	✓	22
SIMAZINE/PRINCEP <2 kg ai/ha	22	22	22	10	22	22	22	22	22	22	22	10	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
SIMAZINE/PRINCEP >2 kg ai/ha	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22	22
ULTIM	f	f	f	f	10	f	f	f	f	f	f	10	f	f	f	f	f	f	f	f	10	f	f	f	f	f	10	f
ULTIM TOTAL**	f	f	f	f	10	f	f	f	f	f	f	10	f	f	f	f	f	f	f	f	10	f	f	f	f	f	10	f
VALTERA	12	9	9	f	f	f	f	f	f	f	f	f	f	f	f	f	f	12	f	f	f	12	f	f	f	f	f	f
VIOS G3	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f	f

FIELD BIOASSAY SERVICE:

A&L Laboratories provides a bioassay service to assist in making re-crop decisions.

For More Information Contact:
A&L Laboratories Canada Ltd., 2136 Jet Stream Road, London, ON N5V 3P5
www.alcanada.com

TABLE 4–6. Weed Populations Confirmed Resistant to Herbicide Groups in Ontario Counties[1]

WSSA GROUP[2] From Table 4–1, "TABLE 4–1. Herbicides Used in Ontario" on page 30	**Site of Action**	**Confirmed herbicide resistant weeds in Ontario (As of Sept, 2015)**	**Location(s)**
1	Inhibitors of acetyl CoA carboxylase (ACCase)	Large crabgrass	Chatham-Kent
2	Inhibitors of acetolactate synthase (ALS) and also called acetohydroxyacid synthase (AHAS)	Redroot and green pigweed[3]	Bruce; Elgin; Essex; Hamilton–Wentworth; Haldimand; Huron; Kent; Lambton; Lennox & Addington; Middlesex; Oxford; Perth; Simcoe; Stormont, Dundas & Glengarry; Wellington
		Lamb's-quarters[3]	Elgin; Essex; Kent; Lambton; Middlesex; Simcoe; Stormont, Dundas & Glengarry
		Green foxtail	Huron; Lambton; Oxford; Perth; Wellington; Victoria
		Giant foxtail	Essex; Elgin; Lambton; Oxford
		Cocklebur	Lambton
		Eastern black nightshade	Bruce; Carleton; Elgin; Huron; Middlesex; Oxford; Perth; Simcoe; Stormont, Dundas & Glengarry; Wellington
		Common ragweed	Bruce; Carleton; Elgin; Essex; Haldimand–Norfolk; Huron; Kent; Lambton; Middlesex; Niagara; Oxford; Perth; Prexcott–Russell; Simcoe; Stormont, Dundas & Glengarry; Wellington
		Waterhemp	Bruce; Lambton; Essex
3	Microtubule assembly inhibitors	Currently none confirmed.	
4	Synthetic auxins	Wild carrot	Halton; Wellington
5	Inhibitors of photosynthesis at photosystem II, Site A	Barnyard grass	Waterloo
		Common groundsel	York
		Common ragweed	Brant; Essex; Haldimond–Norfolk; Hamilton–Wentworth; Lambton; Lennox & Addington; Niagara; Wellington
		Goosefoot	Brant
		Lamb's-quarters[4]	Numerous counties throughout Ontario
		Green pigweed[4]	Elgin; Huron; Oxford; Simcoe; Wellington
		Redroot pigweed[4]	Kent; Simcoe; Stormont, Dundas & Glengarry; Waterloo
		Waterhemp	Essex; Lambton
		Wild mustard	Former Glengarry (Now Stormont, Dundas & Glengarry)
		Witchgrass	Grey; Haldimond-Norfolk; Leeds & Grenville; Prescott–Russell; Wellington
		Yellow foxtail	York

[1] If you suspect that you have a herbicide resistant weed contact the Department of Plant Agriculture, University of Guelph at 519-824-4120 Ext 58372 for more information on testing services.

[2] Herbicide groupings for Ontario follow the Weed Science Society of America's nationally accepted grouping. Groups 12, 13, 16, 17, 18, 21, 24, 25 and 26 are not available in Ontario.

[3] Populations exist that are also resistant to group 5 herbicides.

[4] Populations also exist that are resistant to group 2 herbicides.

TABLE 4–6. Weed Populations Confirmed Resistant to Herbicide Groups in Ontario Counties[1] (cont'd)

WSSA GROUP[2] From Table 4–1, page 30	**Site of Action**	**Confirmed herbicide resistant weeds in Ontario (As of Sept, 2015)**	**Location(s)**
6	Inhibitors of photosynthesis at photosystem II, Site B	Redroot pigweed	Essex; Kent
		Smooth pigweed	Essex
7	Inhibitors of photosynthesis at photosystem II, Site B (alternate binding site)	Green pigweed	Middlesex; Simcoe
		Redroot pigweed	Huron; Chatham; Kent; Middlesex; Simcoe
8	Conjugation of acetyl co-enzyme A	Currently none confirmed.	
9	Inhibitors of 5-enolpyruvylshikimimate-3-phosphate synthase (EPSP)	Canada fleabane	Elgin; Essex; Huron; Kent; Lampton; Niagara
		Common ragweed	Essex
		Giant ragweed	Essex; Kent; Lambton; Lennox; Addington
		waterhemp	Kent County
10	Inhibitors of glutamine synthetase	Currently none confirmed.	
11	Inhibitors of carotenoid biosynthesis	Currently none confirmed.	
13	Diterpene synthesis inhibitor	Currently none confirmed.	
14	Inhibitors of protoporphyrinogen oxidase (Protox)	Currently none confirmed.	
15	Conjugation of acetyl co-enyme A	Currently none confirmed.	
19	Inhibitors of auxin transport system	Currently none confirmed.	
20	Inhibits cell wall synthesis, Site A	Currently none confirmed.	
22	Photo system I – electron diverters	Canada fleabane	Essex
		Eastern black nightshade	Chatham-Kent
		Field peppergrass	Essex
23	Inhibitors of mitosis	Currently none confirmed.	
27	Inhibitors of p-hydroxyphenyl pyruvate dioxygenase (HPPD)	Currently none confirmed.	

[1] If you suspect that you have a herbicide resistant weed contact the Department of Plant Agriculture, University of Guelph at 519-824-4120 Ext 58372 for more information on testing services.

[2] Herbicide groupings for Ontario follow the Weed Science Society of America's nationally accepted grouping. Groups 12, 13, 16, 17, 18, 21, 24, 25 and 26 are not available in Ontario.

[3] Populations exist that are also resistant to group 5 herbicides.

[4] Populations also exist that are resistant to group 2 herbicides.

Interval Before Rainfall (Postemergence)

Rainfall shortly after application of a postemergence herbicide may reduce the weed control. This effect varies with the product, the formulation, the interval of time and the drying conditions between application and rainfall, as well as on the amount, intensity and duration of rainfall. The following information is based on label information and additional detail supplied by the chemical industry. For further information, contact the manufacturer. In the case of a tank-mix, use the longest time interval of the products being considered.

0 to 15 Minutes

DIMENSION
DIQUASH
GRAMOXONE
REGLONE
REWARD

1 Hour

2,4-DB
(e.g., EMBUTOX)
ACHIEVE, BISON
ASSURE II/YUMA GL
AXIAL BIA
bromoxynil/MCPA
(e.g., BUCTRIL M)
bromoxynil
(e.g., PARDNER)
ECOCLEAR
ENLIST DUO
EXCEL SUPER
FACTOR 540
HALEX GT
INFINITY
POAST ULTRA
PUMA, BENGAL, VIGIL
REFINE SG
ROUNDUP ULTRA2
ROUNDUP
WEATHERMAX
SELECT, ARROW

2 Hours

2,4-D Ester
ACCENT
AIM EC
atrazine
CLASSIC/
CHAPERONE
dichlorprop/2,4-D
(e.g., ESTAPROP)
FIRSTRATE
GALAXY 2
(sold as a co-pack)
impact
imazethapyr
(e.g., PURSUIT)
MCPA ester
OPTION 2.25 OD
PRISM
TORDON 101
ULTIM
VENTURE L

3 Hours

ACCLAIM SUPER
CALLISTO GT
GOAL 2XL
HALEX GT
SWORD/TARGET

4 Hours

2,4-D amine
BATTALION
(sold as a co-pack)
dicamba
(e.g., BANVEL II)
DISTINCT
DYCLEER
DYVEL
FLEXSTAR GT)
IGNITE
LIBERTY 200 SN
LONTREL
MARKSMAN
MCPA amine
MCPA/MCPB
(e.g., TOPSIDE)
MUSTER
PEAK
PINNACLE
REFINE M
REFLEX
SAVAGE
TORDON
101 TROPHY
(sold as a co-pack)

6 Hours

BASAGRAN
BASAGRAN FORTÉ
BLAZER
CLEANSWEEP
(sold as a co-pack)
glyphosate*

* Most glyphosate products do not specify an exact rainfast period, but rather state that "heavy rainfall immediately after application may wash the chemical off the foliage" and to "not apply if rainfall is forecasted for the time of application." Field experience has shown that a 6 hour period of no rainfall after application has generally been adequate for glyphosate to perform satisfactorily.

MCPA sodium
PYRAMIN FL
SENCOR UPBEET

8 Hours

LOROX

24 Hours

MECOTURF plus
2,4-D

5. NOTES ON ADJUVANTS

Introduction

An adjuvant is any substance added to a spray solution to modify and enhance the effectiveness of the herbicide.

Adjuvants are an important part of the spray solution and if not used will negatively affect the degree of weed control obtained. Some products have adjuvants formulated into the product while other products require that the user add the adjuvant. The selection of adjuvants is key to obtaining the right balance between maximizing weed control and minimizing crop injury. In some cases the rate of adjuvant varies depending on conditions of weather, crop stage, weed species, water quality, etc. Some herbicide labels recommend particular adjuvant products and some recommend particular types of adjuvants. Always use adjuvants as directed on the product label.

Most adjuvants referred to in this guide are listed as the amount (in litres) added to 1,000 L (L/1,000 L) of spray solution. If you wish to convert to % volume/volume (v/v) use the following conversion:

10 L/1,000 L = 1% v/v

There are 2 broad categories of adjuvants:

- activators and spray modifiers, and
- utility modifiers.

Activators and Spray Modifiers

- **Surfactants** (also known as "surface active agents") are the largest class of adjuvants. Surfactants can be non-ionic, anionic, cationic or amphuteric. Most surfactants are non-ionic (NIS); that is they do not ionize. A NIS is used to enhance herbicide penetration into a waxy cuticle. Wetting agents and detergents are primarily anionic and when ionized in solution, the water soluble portion is negatively charged. Cationic surfactants exhibit a net positive charge in solution. Amphuteric surfactants can be either anionic or cationic. Cationic and amphuteric surfactants are not widely used in agricultural chemicals.

- **Oils** solubilize the waxy cuticle layer on a weed leaf surface to increase spray penetration through the leaf cuticle. Oils are refined mineral oils (petroleum based) or seed oils. Seed oils are categorized as triglycerides, methylated seed oils (MSO) or crop oil concentrates (COC). Crop oil concentrates are a combination of seed oil and surfactants.

Utility Modifiers

- **Compatibility** agents improve mixing, especially when using a liquid fertilizer carrier.

- **Drift control** agents increase the droplet size to reduce drift.

- **Anti-foaming/Defoaming** agents are used to reduce and prevent foaming in the spray tank.

- **Foaming** agents are used with specialized equipment to produce and apply foam.

- **Buffering** agents can be used to enhance solubility or adjust pH.

- **Dyes are used** in some instances to enhance visibility of spray foam solutions.

Note

Complete information on each adjuvant is available on the product label which is located on the product container. The federal Pest Management Regulatory Agency also lists pesticide labels on their website.

Many pesticide manufacturers also list product labels and/or Material Safety Data Sheets (MSDS) on their websites that are listed on page 455 of this publication.

TABLE 5–1. Adjuvants Used in Ontario

LEGEND: N/A = not applicable. These types of products are not required to be classified under the *Pesticide Control Product Act* (PCPA).

Trade Names[1]	**Registration (PCP) Number**[2]	**Chemical Composition**	**Concentration**	**Ontario Classification**[3]	**Manufacturer/ Agent Code**[4]
Non-Ionic Surfactants					
AGRAL 90	11809	nonylphenoxy polyethyoxyethanol	90%	3	NOR
AGRAL 90	24725	nonylphenoxy polyethyoxyethanol	90%	3	SYN
CITOWETT PLUS	12766	ocylphenoxy-polyethoxy ethanol	50%	4	BAZ
CONTACT	28326	alkylarylpolyoxyethylene glycols, free fatty acids and isopropyl alcohol	900 g/L	4	NOR
COMPANION	15882	ocylphenoxy-polyethoxy-(9) ethanol	70%	4	DWE
ENHANCE	29270	triglyceride ethoxylate	80%	4	NOR
ICON	28342	nonylphenoxy polyethyoxyethanol	90%	4	NOR
INDEX	28181	alkylarylpolyoxyethylene glycols, free fatty acids and isopropyl alcohol	900 g/L	4	NOR
IPCO AG-SURF	15881	nonylphenoxy polyethyoxyethanol	92%	3	INT
LI700	23026	phosphatidylcholine, methylacetic acid, alky polyoxyethylene ether	80%	4	LOI
LIBERATE	29491	lecithin, methyl esters of fatty acids and alcohol ethoxylate	100 g/L	3	LOI
LINK	28291	alkylarylpolyoxyethylene glycols, free fatty acids and isopropyl alcohol	900 g/L	4	NOR
NUFARM AG-SURF	27921	nonylphenoxy polyethyoxyethanol	92%	4	NUA
PRO-SURF II	28327	alkylarylpolyoxyethylene glycols, free fatty acids and isopropyl alcohol	900 g/L	4	NOR
SENTRY	28343	nonylphenoxy polyethyoxyethanol	90%	4	NOR
SIDEKICK	25835	alkylarylpolyoxyethylene glycols, free fatty acids and isopropyl alcohol	900 g/L	4	NOR
SIDEKICK II	28914	alkylarylpolyoxyethylene glycols, free fatty acids and isopropyl alcohol	900 g/L	4	NOR
SUFFIX	28184	nonylphenoxy polyethyoxyethanol	90%	4	NOR
SUPER SPREADER	17402	ocylphenoxy-polyethoxy ethanol	50%	4	UAG
WEEDAWAY AG SURF	22881	nonylphenoxy polyethyoxyethanol	92%	3	INT

[1] Mention of a trade name in this table does not constitute a guarantee or warranty of the product. Neither does this use signify that these products are approved to the exclusion of comparable products. All trade names are capitalized in this guide.

[2] The product registration number for this trade name under the *Pesticide Control Product Act*, commonly referred to as a "PCP number". The PCP number has been placed in the guide for convenience, but the pesticide label should always be used for the most accurate and current PCP number.

[3] Designated under the *Pesticide Control Product Act* (PCPA) as pesticides of the Commercial Class for use in commercial activities that are specified on the label or Restricted Class when the label specifies essential conditions respecting the display, distribution or limitations on the use of, or qualifications of persons who may use the product. The Ontario Classification is current as of time of printing and may change over time. Refer to the Ontario Pesticide Advisory Committee Website, opac.gov.on.ca, for most current classifications.

[4] See Appendix G. *Herbicide Companies and Agents*, page 455. Phone numbers and websites are also listed.

TABLE 5–1. Adjuvants Used in Ontario (cont'd)

LEGEND: N/A = not applicable. These types of products are not required to be classified under the *Pesticide Control Product Act* (PCPA).

Trade Names[1]	Registration (PCP) Number[2]	Chemical Composition	Concentration	Ontario Classification[3]	Manufacturer/ Agent Code[4]
Solvents (Oils)/Surfactants					
ADDIT ADJUVANT	29263	surfactant	36.9%	4	MKC
AMIGO	22644	phosphate ester surfactant	30%	2	BCZ
ASSIST OIL CONCENTRATE	16937	paraffin base mineral oil + surfactant blend	83% + 17%	4	BAZ
HASTEN NT	28277	methyl and ethyl oleate	71.4%	4	VCT
MANA X-ACT	28225	phosphate ester surfactant	30%	2	MKC
MERGE	24702	surfactant blend + solvent (petroleum hydrocarbons)	50% + 50%	4	BAZ
MERGE [1]	21058	surfactant blend + solvent (petroleum hydrocarbons)	50% + 50%	4	BAZ
MSO CONCENTRATE	28385	methylated seed oil of soybean	70%	4	LOI
SURE-MIX	25467	paraffinic petroleum oil + surfactant blend	60% + 35.6%	4	DUQ
SYLGARD 309	23078	silicone polyether + surfactant blend	76% + 24%	4	NOR
TURBOCHARGE	23135	paraffin base mineral oil + surfactant blend	50% + 39.5%	4	SYN
XA OIL CONCENTRATE	11769	paraffin base mineral oil + surfactant blend	83% + 17%	4	UAG
Combatibility Agents					
ALLIANCE	N/A	aliphatic phosphate ester, isopropanol and glycol ethers	69%	N/A	NOR
UNITE	N/A	acid polyglycols and methyl alcohol	83.70%	N/A	UAG
Water Buffering Agents					
AQUA-STABLE	N/A	aliphatic polycarboxylate and calcium chloride	28%	N/A	NOR
Water Conditioning Agents					
AQUASOFT	N/A	hydroxy carboxylic acid, phosphoric acids and ammonium sulfate polyacrylic acid	63%	N/A	NOR
CHOICE	N/A	polyacrylic, hydroxy carboxylic, propionic acids, phosphate ester and ammonium sulfate	50%	N/A	UAG
N TANK	N/A	monocarbamide dihydrogen sulphate, amine phosphates and viscosity reducing agents	81%	N/A	ADJ

[1] Mention of a trade name in this table does not constitute a guarantee or warranty of the product. Neither does this use signify that these products are approved to the exclusion of comparable products. All trade names are capitalized in this guide.

[2] The product registration number for this trade name under the *Pesticide Control Product Act*, commonly referred to as a "PCP number". The PCP number has been placed in the guide for convenience, but the pesticide label should always be used for the most accurate and current PCP number.

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TABLE 5–1. Adjuvants Used in Ontario (cont'd)

LEGEND: N/A = not applicable. These types of products are not required to be classified under the *Pesticide Control Product Act* (PCPA).

Trade Names[1]	Registration (PCP) Number[2]	Chemical Composition	Concentration	Ontario Classification[3]	Manufacturer/ Agent Code[4]
Defoamers (Anti-Foamers)					
BREAKER	N/A			N/A	UAG
FIGHTER F	N/A	dimethylpolysiloxane	10%	N/A	UAG
FLAT-OUT	N/A	dimethylpolysiloxane	20%	N/A	NOR
HALT	N/A	silicone base, neutral	30%	N/A	DWE
VALID	N/A	lecithin, emulsifiers, glycols and dimethylpolysiloxane defoamer	100%	N/A	UAG
ZAP	N/A	proprietary blend	100%	N/A	NOR
Foam Marker Dye					
IN-SIGHT	N/A	dye, surfactants, and coupling agents	100%	N/A	NOR
TREKKER TRAX	N/A	alcohols, mixed anionic and nonionic surfactants	54%	N/A	UAG
TRAMLINE	N/A	nonionic and anionic surfactants	35% + 65%	N/A	NOR

[1] Mention of a trade name in this table does not constitute a guarantee or warranty of the product. Neither does this use signify that these products are approved to the exclusion of comparable products. All trade names are capitalized in this guide.

[2] The product registration number for this trade name under the *Pesticide Control Product Act*, commonly referred to as a "PCP number". The PCP number has been placed in the guide for convenience, but the pesticide label should always be used for the most accurate and current PCP number.

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[4] See Appendix G. *Herbicide Companies and Agents*, page 455. Phone numbers and websites are also listed.

TABLE 5–2. Adjuvant Rates per Sprayer Tank Volume

% Adjuvant / Water	0.1% v/v	0.2% v/v	0.25% v/v	0.5% v/v	1.25% v/v
L Adjuvant / L Water	1 L/1,000 L	2 L/1,000 L	2.5 L/1,000 L	5 L/1,000 L	12.5 L/1,000 L
L Adjuvant / U.S. gal. Water	0.38 L /100 U.S. gal.	0.76 L /100 U.S. gal.	0.95 L /100 U.S. gal.	1.9 L/100 U.S. gal.	4.75 L/100 U.S. gal.

AGRAL 90

Type of Adjuvant: Non-ionic surfactant.

Chemical Composition: Nonylphenoxy polyethyoxyethanol 90%.

Registered Uses: For use with REGLONE, glyphosate, REFLEX and other control products as labelled. Also used for washing sprayer tanks and equipment.

Benefit: Improves chemical effectiveness.

Mode of Action: It is a wetting and spreading agent that improves coverage of spray mixes.

Mixing: Use 200– 2,500 mL/1,000 L of water as specified on label. Will mix with all types of water (i.e., hard and soft). Add AGRAL 90 to the spray mixture and agitate thoroughly. With glyphosate, use 350 mL/50–100 L water if targeting quackgrass in minimum or zero tillage seeding and summerfallow uses. Use 500 mL/100 L for quackgrass when water volumes are high (i.e., 150–300 L/ha).

Unique Characteristics: Do not exceed the labelled rates of AGRAL 90 as too much wetting agent can lead to loss of spray due to excessive run-off.

ALLIANCE 400

Type of Adjuvant: Compatibility agent.

Chemical Composition: Aliphatic phosphate ester, isopropanol and glycol ethers 69%.

Benefit: Emulsifies and disperses liquid fertilizers and emulsifiable pesticides in solution to produce uniform tank-mixes.

Mixing: Mix 60–375 mL of Alliance/100 L of solution depending on fertilizer and number of pesticides. Add alliance to the fertilizer solution before the pesticide.

AMIGO

Type of Adjuvant: Surfactant.

Chemical Composition: 30% phosphate ester surfactant.

Registered Uses: For use with SELECT and SELECT tank-mixes.

Benefit: Improves chemical effectiveness under varying environmental conditions.

Mode of Action: Improves spreading of spray droplets on the leaf surface and increases contact area. Enhances penetration of herbicide through the leaf cuticle layer.

Mixing: Half-fill spray tank with water and start agitation. Add the correct amount of herbicide, agitate and then add the correct amount of AMIGO with the remaining water. Continue to agitate.

AQUASOFT

Type of Adjuvant: Water conditioning agent.

Chemical Composition: Proprietary blend of hydroxy carboxylic acid, phosphoric acids and ammonium sulfate polyacrylic acid 63%.

Benefit: Eliminates hard water antagonism as well as formulation instability due to high pH.

Mode of Action: Conditions water by sequestering and chelating hard water ions and reducing the pH.

Mixing: 100–750 mL/100 L of spray solution, depending on water hardness. Always check compatibility with a jar test.

AQUA-STABLE

Type of Adjuvant: Buffering agent.

Chemical Composition: Aliphatic polycarboxylate and calcium chloride 28%.

Benefit: Lowers the pH of the spray water and reduces pesticide breakdown from alkaline spray solutions.

Mode of Action: Acidifies and buffers spray solution.

Mixing: 60–250 mL/100 L of spray solution, depending on the alkalinity.

ASSIST OIL CONCENTRATE

Type of Adjuvant: Mineral oil/surfactant (non-herbicidal).

Chemical Composition: 83% paraffin base mineral oil plus 17% surfactant blend.

Registered Uses: ASSIST OIL CONCENTRATE is registered for use with BASAGRAN, BLAZER, IMPACT, LADDOK, POAST and atrazine.

Benefit: Using ASSIST results in improved postemergence activity and a greater degree of consistency under varying environmental conditions. ASSIST also aids in providing a faster weed kill.

Mode of Action: Reduces the evaporation of spray droplets on the leaf surface leading to a longer period for penetration. Improves penetration through the leaf cuticle layer. ASSIST also aids in spreading a spray droplet on the leaf surface so that it covers a greater surface area.

Mixing: Half-fill the spray tank with water and begin agitation. Add the desired amount of herbicide and continue filling. Add ASSIST last. After filling, continue agitation. Agitate thoroughly after any stoppage in spraying.

Unique Characteristics: May cause increased temporary topical burn to crop plants under hot, humid weather conditions.

BREAKER

Type of Adjuvant: Antifoamer/defoamer.

Registered Uses: To reduce foaming when preparing herbicide spray mixes.

Benefit: Small quantities of BREAKER added before adding herbicides will prevent foam from forming.

Mixing: Add 7 mL/500 L of spray mix.

Unique Characteristics: Can be added after foam has formed but more time will be required to eliminate the foam.

BUFFERING AGENTS

See AQUA-STABLE.

CITOWETT PLUS

Type of Adjuvant: Non-ionic surfactant.

Chemical Composition: Ocylphenoxy-polyethoxy ethanol 50%.

Registered Uses: For use with atrazine, BASAGRAN, TELAR, MUSTER, REFINE, PINNACLE and other control products as labelled.

Benefit: Improves chemical effectiveness.

Mode of Action: It is a spreading and sticking agent that improves coverage of spray mixes.

CHOICE

Type of Adjuvant: Water conditioning agent.

Chemical Composition: Blend of polyacrylic, hydroxy carboxylic, propionic acids, phosphate ester and ammonium sulfate.

Benefit: Eliminates hard water antagonism and instrability due to high pH.

Mode of Action: Conditions water by sequestering or chelating hard water ions and by the reduction in pH.

Mixing: 2.5–7.5 L/1,000 mL water.

COMPANION

Type of Adjuvant: Non-ionic surfactant.

Chemical Composition: Octylphenoxy-polyethoxy-(9)-ethanol 70%.

Registered Uses: Glyphosate, TELAR, MUSTER and other products as labelled.

Benefit: Improves chemical effectiveness.

Mode of Action: It is a wetting and spreading agent that improves coverage of spray mixes.

Mixing: With glyphosate, for the control of annual grasses and broadleaf weeds, add 450 mL of COMPANION in 50–100 L of water/ha. With TELAR, add 100 mL of COMPANION to 100 L of water for the control of broadleaf weeds. Use constant agitation.

Unique Characteristics: Do not exceed the labelled rates of COMPANION as too much may reduce the effectiveness of the herbicide due to excessive run-off.

CONTACT

Type of Adjuvant: Non-ionic surfactant.

Chemical Composition: Alkylarylpolyoxyethylene glycols, free fatty acids and isopropyl alcohol at 900 g/L.

Registered Uses: For use with glyphosate*. TELAR, REFINE, MUSTER and other control products as labelled.

Benefit: Improves chemical effectiveness.

Mode of Action: It is a spreading and sticking agent that improves coverage of spray mixes.

COMPATABILITY AGENTS

See ALLIANCE 400, UNITE.

DEFOAMERS/ANTIFOAMERS

See BREAKER, FIGHTER F, FLAT-OUT, HALT, VALID, ZAP.

DRIFT-CONTROL AGENTS

See VALID.

ENHANCE NON-IONIC SPRAY ADJUVANT

Type of Adjuvant: Non-ionic multipurpose adjuvant.

Chemical Composition: Triglyceride Ethoxylate 80%.

Registered Uses: ENHANCE can be used with glyphosate (numerous products exist, refer to Table 4–1. *Herbicides Used in Ontario,* page 30 for a complete list of products), REGLONE, PURSUIT, ACCENT, ULTIM, REFINE and a wide range of other products as labelled.

Benefit: Improves chemical effectiveness.

Mode of Action: ENHANCE works by several modes of action which results in improving wetting, spreading and penetrative properties.

Mixing: Use 200–2,500 mL/1,000 L of water as specified on label. Will mix with all types of water (i.e., hard and soft). Add AGRAL 90 to the spray mixture and agitate thoroughly. For use with ROUDNUP and other glyphosate products use 350 mL/50–100 L for quackgrass, minimum or zero tillage seeding and summerfallow uses. Use 500 mL/100 L for quackgrass for water volume of 150–300 L/ha.

Unique Characteristics: ENHANCE contains no nonylphenoxy polyethoxy ethanol (NPE's). Do not exceed labelled rates of ENHANCE as this may cause run-off.

FIGHTER F

Type of Adjuvant: Antifoamer/defoamer.

Chemical Composition: Dimethyl-polysiloxane 10%.

Registered Uses: To control foam in water, oil, fertilizer and pesticide spray mixtures.

Benefit: Controls foam when mixing sprays, eliminates material waste, provides more accurate metering of agricultural sprays, and eliminates foam overflow at fill site.

Mixing: To control foam when mixing spray solution, add defoamer either just before or during addition of any other spray adjuvant. To cut existing foam, add defoamer to tank and recirculate solution until foam dissipates.

FLAT-OUT

Type of Adjuvant: Antifoamer/defoamer.

Chemical Composition: Dimethylpolysiloxane 20% Silicone base neutral.

Registered Uses: To control foam formation or existing foam, use as premix or add while spray tank is being filled.

Benefit: The reduction of foam allows for faster tank fill, ensures fill volumes are correct and reduces the possibility of chemical overflow, therefore more accurate application. It also makes the cleaning process easier.

Mixing: Add 5–10 mL/100 L of solution. Adjust the amount required according to individual conditions. May be used before mixing to prevent foam, or after to cut foam. May be used with any herbicide unless contra-indicated on the label.

FOAM MARKER DYES

See IN-SIGHT, TRAMLINE, TREKKER TRAX.

HALT

Type of Adjuvant: Defoamer.
Chemical Composition: Silicone base, neutral.
Registered Uses: To reduce foaming when preparing herbicide spray mixes.
Benefit: The reduction of foaming allows faster tank fill-ups, ensures correct fill volumes, reduces the possibility of chemical overflow and gives more accurate herbicide application.
Mixing: Add 7 mL/500 L of spray mix. May be added to spray tank during filling to prevent foaming, or after to cut foam.
Unique Characteristics: May be used with any herbicide unless otherwise stated on the product label.

HASTEN NT

Type of Adjuvant: Non-ionic esterified vegetable oil.
Chemical Composition: Methyl and ethyl oleate 71.44%.
Registered Uses: For use with REFINE SG, ESCORT, TELAR and other herbicides as labelled.
Benefit: Improves herbicide uptake.
Mixing: Use 5 L/1,000 L of spray solution.

ICON

Type of Adjuvant: Non-ionic surfactant.
Chemical Composition: Nonylphenoxy polyethyoxyethanol 90%.
Registered Uses: For use with REGLONE, glyphosate, REFLEX and other control products as labelled. Also used for washing sprayer tanks and equipment.
Benefit: Improves chemical effectiveness.
Mode of Action: It is a wetting and spreading agent that improves coverage of spray mixes.
Mixing: Use 200–2,500 mL/1,000 L of water as specified on label. Will mix with all types of water. Add ICON to the spray mixture and agitate thoroughly. With glyphosate, use 350 mL/50–100 L water if targeting quackgrass in minimum or zero tillage seeding and summerfallow uses. Use 500 mL/100 L for quackgrass when water volumes are high (i.e., 150–300 L/ha).
Unique Characteristics: Do not exceed the labelled rates of ICON as too much wetting agent can lead to loss of spray due to excessive run-off.

INDEX

Type of Adjuvant: Non-ionic surfactant.
Chemical Composition: Alkylarylpolyoxyethylene glycols, free fatty acids and isopropyl alcohol at 900 g/L
Registered Uses: For use with ASSURE, PURSUIT, ULTIM, ACCENT and other control products as labelled.
Benefit: Improves chemical effectiveness.
Mode of Action: It is a spreading and sticking agent that improves coverage of spray mixes.

IN-SIGHT

Type of Adjuvant: Foam marker dye.
Active Ingredients: Dye, surfactants, and coupling agents.
Uses: As a colour dye marker for foam markers and as a dye marking agent for turf applications.
Benefit: Allows foam marking systems to show up under poor visibility conditions of low light, heavy trash, no-till, snow or fog.
Mixing: Use 15–30 mL/100 L of spray solution.

IPCO AG-SURF

Type of Adjuvant: Non-ionic surfactant.
Chemical Composition: Nonylphenoxy polyethyoxyethanol 92%.
Registered Uses: For use with REGLONE, glyphosate (numerous products exist, refer to Table 4–1. *Herbicides Used in Ontario*, page 30 for a complete list of products) and other control products as labelled.
Benefit: Improves chemical effectiveness.
Mode of Action: It is a wetting and spreading agent that improves coverage of spray mixes.

LI700

Type of Adjuvant: Non-ionic surfactant and pH adjuster/acidifier.
Chemical Composition: Phosphatidylcholine, methylacetic acid and alkyl polyoxyethylene ether 80%.
Registered Uses: REGLONE and for use with glyphosate products. LI700 neutralizes or slightly acidifies the spray solution and prevents the breakdown hydrolysis of pH-sensitive products in the spray tank. Add LI700 before adding the pesticide.
Benefit: Improves chemical effectiveness.
Mixing: As a penetrating surfactant: Use 5 L/1,000 L of water or 500 mL/100 L of water. As a pH adjuster/acidifier: Highly alkaline water, (pH 8 or higher). Use: 625 mL–1.25 L/1,000 L water mixture.

MANA X-ACT

Type of Adjuvant: Surfactant.
Chemical Composition: 30% phosphate ester surfactant.
Registered Uses: For use with ARROW and ARROW tank-mixes.
Benefit: Improves chemical effectiveness under varying environmental conditions.
Mode of Action: Improves spreading of spray droplets on the leaf surface and increases contact area. Enhances penetration of herbicide through the leaf cuticle layer.
Mixing: Half-fill spray tank with water and start agitation. Add the correct amount of herbicide, agitate and then add the correct amount of MANA X-ACT with the remaining water. Continue to agitate.

MERGE, MERGE 1

Type of Adjuvant: Surfactant/solvent.
Chemical Composition: 50% surfactant blend plus 50% solvent (petroleum hydrocarbons).
Registered Uses: For use with ERAGON, IMPACT, POAST ULTRA and other products as labelled.
Benefit: Improves chemical effectiveness and provides a greater degree of consistency under varying environmental conditions.
Mode of Action: Improves spreading of spray droplets on the leaf surface and increases contact surface area. Improves penetration of herbicide through the leaf cuticle layer. Acts as a protectant against photodegradation of POAST ULTRA by UV light.
Mixing: Half-fill spray tank with water, start agitation. Add required amount of herbicide and continue agitation. Add MERGE, along with remaining water, last to the tank. Agitate thoroughly after any stoppage in spraying.
Unique Characteristics: May cause temporary topical burn to crop plants under hot, humid weather conditions.

MINERAL OIL/SURFACTANT (NON-HERBICIDAL)

See ASSIST OIL CONCENTRATE, XA OIL CONCENTRATE.

N TANK

Type of Adjuvant: Water conditioning and compatibility agent.
Chemical Composition: A blend of monocarbamide dihydrogen sulphate, amine phosphates and viscosity reducing agents at 81%.
Benefit: Eliminates hard water antagonism. Prevents loss of herbicide activity that can occur when certain micronutrients are tank-mixed with glyphosate.
Mode of Action: Conditions water by sequestering and chelating hard water ions and added miconutrients.
Mixing: Add 0.25–1 L per 100 L spray solution prior to the addition of micronutirents and certain pesticides, the exception being sulphonylurea herbicides (e.g., ACCENT, PINNACLE SG) which should be added first and fully dissolved prior to adding N TANK. Always check mixing compatibility first with a jar test.

NUFARM AG-SURF

Type of Adjuvant: Non-ionic surfactant.
Chemical Composition: Nonylphenoxy polyethyoxyethanol 92%.
Registered Uses: For use with REGLONE, glyphosate (numerous products exist, refer to Table 4–1. *Herbicides Used in Ontario*, page 30 for a complete list of products) and other control products as labelled.
Benefit: Improves chemical effectiveness.
Mode of Action: It is a wetting and spreading agent that improves coverage of spray mixes.

OIL

See MINERAL OIL.

PRO-SURF II

Type of Adjuvant: Non-ionic liquid spreader/activator.
Chemical Composition: Alkylarylpolyoxyethylene glycols, free fatty acids and isopropyl alcohol; 900g/L.
Registered Uses: For use with PURSUIT, ACCENT, ASSURE II, ULTIM, and other products as labelled.
Benefit: Improves spray chemical effectiveness.
Mode of Action: It is a wetting and spreading agent that improves coverage of spray mixtures.
Mixing: Make sure the spray tank is thoroughly cleaned before mixing. Fill the spray tank half full with water. Add the required amount of herbicide as directed by its label with the agitator running. Ensure that the herbicide is completely mixed before proceeding to the next step. Slowly add the PRO-SURF II, agitating during the entire process. Continue to agitate while filling the tank with water and agitate before and during each application to ensure a uniform spray.
Unique Characteristics: Do not exceed labelled rates of PRO-SURF II, as too much may reduce the effectiveness of the herbicide due to excessive run-off. Consult product label for full directions.

SENTRY

Type of Adjuvant: Non-ionic surfactant.
Chemical Composition: Nonylphenoxy polyethyoxyethanol 90%.
Registered Uses: For use with REGLONE, glyphosate and other control products as labelled.
Benefit: Improves chemical effectiveness.
Mode of Action: It is a wetting and spreading agent that improves coverage of spray mixes.

SIDEKICK, SIDEKICK II

Type of Adjuvant: Non-ionic liquid spreader/activator.
Chemical Composition: Alkylarylpolyoxyethylene glycols, free fatty acids and isopropyl alcohol; 900 g/L.
Registered Uses: For use with PURSUIT, ACCENT, ASSURE II, ULTIM and other products as labelled.
Benefit: Improves spray chemical effectiveness.
Mode of Action: It is a wetting and spreading agent that improves coverage of spray mixtures.
Mixing: Make sure the spray tank is thoroughly cleaned before mixing. Fill the spray tank half full with water. Add the required amount of herbicide as directed by its label with the agitator running. Ensure that the herbicide is completely mixed before proceeding to the next step. Slowly add the SIDEKICK II, agitating during the entire process. Continue to agitate while filling the tank with water and agitate before and during each application to insure a uniform spray.

Unique Characteristics: Do not exceed labelled rates of SIDEKICK II, as too much may reduce the effectiveness of the herbicide due to excessive run-off. Consult product label for full directions.

SUFFIX

Type of Adjuvant: Non-ionic surfactant.

Chemical Composition: Nonylphenoxy polyethyoxyethanol 90%.

Registered Uses: For use with REGLONE, glyphosate (numerous products exist, refer to Table 4–1. *Herbicides Used in Ontario*, page 30 for a complete list of products) and other control products as labelled.

Benefit: Improves chemical effectiveness.

Mode of Action: It is a wetting and spreading agent that improves coverage of spray mixes.

SUPER SPREADER

Type of Adjuvant: Non-ionic spreader sticker surfactant.

Chemical Composition: Octyl phenoxypoly ethoxy ethanol 50%.

Registered Uses: For use with ACCENT, atrazine, BASAGRAN, MUSTER, PINNACLE, TELAR, PRISM, PYRAMIN FL, REFLEX, ULTIM and other products as labelled.

Benefit: Improves postemergence control of weeds that have reached their upper limit in size for susceptibility.

Mode of Action: Causes the spray mix to form a continuous film on leaf surfaces; also makes herbicide more rainfast.

Mixing: Use 1–2.5 L/ha. Half-fill tank with water; add herbicide with continuous agitation; complete filling of tank with water; add SUPER SPREADER with continuous agitation.

Unique Characteristics: Use the high rate (2.5 L/ha) with hard water.

SURE-MIX

Type of Adjuvant: Paraffinic petroleum oil/surfactant (non-herbicidal).

Chemical Composition: 60% Paraffinic petroleum oil plus 35.6% surfactant blend.

Registered Uses: SURE-MIX is registered for use with ASSURE II, and CLASSIC plus PINNACLE when tank-mixed with ASSURE II.

Benefit: The use of SURE-MIX results in improved activity of ASSURE II and a greater degree of consistency under varying environmental conditions.

Mode of Action: Reduces the evaporation of spray droplets from the leaf surface and decreases the surface tension of spray droplets thus improving penetration through the cuticle of leaf surfaces.

Mixing: Add the required amount of water to the spray tank with agitator running. Add ASSURE II and after well mixed add 5 L of SURE-MIX for each 1,000 L of spray solution.

Unique Characteristics: May cause some minor leaf speckling under hot and humid weather conditions.

SYLGARD 309

Type of Adjuvant: Non-ionic surfactant.

Chemical Composition: Siloxylated polyether 76% + surfactant mixture 24%.

Registered Uses: For use with PURSUIT on soybeans for annual broadleaf and grass control; and glyphosate for quackgrass control and annual broadleaf weed control in summer fallow; and with TORDON 101 for faster burndown of coniferous species on right-of-ways, Basagran on soybeans, Vision Silviculture and Vision Max Silviculture, Vantage Forestry, Ranman 400 SC, Fulfill 50 WG.

Benefits: Improves chemical effectiveness by increasing the amount and rate of uptake of water-soluble herbicides.

Mixing: Use 2.5 L/1,000 L of spray solution for most applications; add this amount last to the spray tank after the herbicide has been thoroughly mixed. Apply the spray solution as soon as possible after mixing.

Unique Characteristics: This organosilicone formulation has lowest surface tension of any adjuvant available.

TRAMLINE

Type of Adjuvant: Foam marker.

Chemical Composition: Nonionic and anionic surfactants, 35% + 65% alcohols and other constituents.

Benefit: Improves placement of herbicides by indicating area of field sprayed, preventing overlaps and misses.

Mixing: Depending on water hardness and mineral content mix 0.63–1 L/100 L of water.

TREKKER TRAX

Type of Adjuvant: Foam marker.

Chemical Composition: 24% alcohols and 30% mixed anionic and nonionic surfactants.

Benefit: Improves placement of herbicides by indicating area of field sprayed.

Mixing: Add 1–2 L of Trekker Trax to 100–150 L water. Use the higher rate of product if mixing with hard water.

TURBOCHARGE

Type of Adjuvant: Surfactant/solvent.

Chemical Composition: 39.5% surfactant blend plus 50% solvent (mineral oil).

Registered Uses: For use with ACHIEVE 40 DG herbicide.

Benefit: Improves chemical effectiveness and provides a greater degree of consistency under varying environmental conditions.

Mode of Action: Improves spreading of spray droplets on the leaf surface and increases contact surface area. Improves penetration of herbicide through the leaf cuticle layer.

Mixing: Half-fill spray tank with water, start agitation. Add required amount of herbicide and continue agitation. Add TURBOCHARGE along with remaining water last to the tank. Agitate thoroughly after any stoppage in spraying. Use at a rate of 0.5 L TURBOCHARGE/100 L of spray mixture. If tank-mixing with other herbicides, always add the TURBOCHARGE last.

UNITE

Type of Adjuvant: Compatibility agent.

Chemical Composition: 83.7% acid polyglycols and methyl alcohol.

Benefit: Improves the compatibility of liquid fertilizer-pesticide mixtures.

Mixing: 240–1,420 mL/378.5 L. Perform a test of physical compatibility of various pesticides and fertilizer mixtures in a small quantity to determine the exact amount of UNITE and the mixing method to be used.

VALID

Type of Adjuvant: Deposition and drift reduction agent, antifoam-defoamer.

Chemical Composition: Lecithin, emulsifiers, glycols and dimethylpolysiloxane defoamer.

Benefit: Small quantities of VALID added before adding pesticides will prevent foam from forming. Adding VALID to the spray tank will also reduce the production of fine spray droplets that may drift.

Mixing: Mix 125 mL/100 L of spray mixture.

WATER CONDITIONING AGENTS

See AQUASOFT, CHOICE and N TANK.

WEEDAWAY AG-SURF

Type of Adjuvant: Non-ionic surfactant.

Chemical Composition: Nonylphenoxy polyethyoxyethanol 92%.

Registered Uses: For use with REGLONE, glyphosate (numerous products exist, refer to Table 4–1. *Herbicides Used in Ontario,* page 30 for a complete list of products) and other control products as labelled.

Benefit: Improves chemical effectiveness.

Mode of Action: It is a wetting and spreading agent that improves coverage of spray mixes.

XA OIL CONCENTRATE

Type of Adjuvant: Mineral oil/surfactant (non-herbicidal).

Chemical Composition: 83% paraffin-base mineral oil plus 17% surfactant blend.

Registered Uses: atrazine, ASSURE/YUMA GL, BASAGRAN, LADDOCK and other products as labelled.

Benefit: May result in improved postemergence activity.

Mode of Action: Reduces the evaporation of spray droplets from the leaf surface and decreases the surface tension of spray droplets, thus improving the penetration through the cuticle of leaf surfaces.

ZAP

Type of Adjuvant: Antifoamer/defoamer.

Chemical Composition: Proprietary blend of ingredients.

Registered Uses: To control foam formation or existing foam Use as premix or add while spray tank is being filled. For agricultural/industrial uses.

Benefit: The reduction of foam allows for faster tank fill, ensures fill volumes are correct and reduces the possibility of chemical overflow. It also makes the cleaning process easier.

Mixing: Add 2–5 mL/100 L of solution. Adjust the amount required according to individual conditions. May be used before mixing to prevent foam, or after to cut foam. May be used with any herbicide unless contra-indicated on the label. Is particularly effective with glyphosate products, which often foam in solution.

6. PREPLANT & POSTHARVEST WEED CONTROL

TABLE 6–1. Non-Selective Herbicides Available for Preplant Site Preparation

LEGEND: ✓= Registered for use as a preplant application prior to this crop. x = not indicated for use on this crop
* = Numerous products exist, refer to Table 4–1. *Herbicides Used in Ontario,* page 30, for a complete list of products.

CROP	AIM EC	BASAMID	ENLIST DUO	ERAGON LQ	glyphosate*	GRAMOXONE	IGNITE	REGLONE	VAPAM
Field Crops									
barley	✓	x	✓	✓	✓	x	x	x	x
corn	✓	x	✓	✓	✓	✓	x	✓	x
peas (field)	✓	x	x	✓	✓	x	x	x	x
soybeans	✓	x	x	✓	✓	✓	x	✓	x
tobacco	x	x	x	x	x	x	x	x	✓
wheat	✓	x	✓	✓	✓	✓	x	x	x
white beans	✓	x	x	x	✓	x	x	x	x
Vegetables									
field vegetable seedbeds	✓	✓	x	x	✓	✓	x	x	✓
stale seed beds	✓	x	x	x	✓	✓	x	✓	x
asparagus	x	x	x	x	✓	x	✓	x	x
beans	✓	x	x	x	✓	✓	x	✓	x
beets	✓	x	x	x	✓	✓	✓	✓	x
carrots	✓	x	x	x	✓	✓	✓	✓	x
celery	✓	x	x	x	✓	x	x	x	x
cole crops	✓	x	x	x	✓	x	x	x	x
corn, sweet	✓	x	x	x	✓	x	x	x	x
cucumber	✓	x	x	x	✓	x	x	x	x
eggplant	✓	✓	x	x	✓	✓	x	x	x
ginseng	x	x	x	x	✓	✓	x	x	x
lettuce	✓	✓	x	x	✓	x	✓	x	x
melons	✓	x	x	x	✓	✓	x	x	x
onions	✓	x	x	x	✓	✓	✓	✓	x
peas	✓	x	x	x	✓	x	x	x	x
peppers	✓	✓	x	x	✓	x	x	x	x

TABLE 6–1. Non-Selective Herbicides Available for Preplant Site Preparation (cont'd)

LEGEND: ✓= Registered for use as a preplant application prior to this crop. x = not indicated for use on this crop
* = Numerous products exist, refer to Table 4–1. *Herbicides Used in Ontario*, page 30, for a complete list of products.

CROP	AIM EC	BASAMID	ENLIST DUO	ERAGON LQ	glyphosate*	GRAMOXONE	IGNITE	REGLONE	VAPAM
Vegetables (cont'd)									
potatoes	✓	x	x	x	✓	x	x	x	x
rutabaga	✓	x	x	x	x	x	x	✓	x
squash	✓	x	x	x	✓	x	x	x	x
tomato	✓	✓	x	x	✓	x	x	x	x
Fruit Crops									
fruit	✓	x	x	x	✓	✓	x	x	✓
berries	✓	x	x	x	✓	x	x	x	x
Nursery Stock									
woody nursery stock	x	✓	x	x	✓	x	x	x	x
herbaceous ornamentals seed and planting beds	x	✓	x	x	x	x	x	x	x
Nursery Stock									
turf seedbeds	x	✓	x	x	x	x	x	x	x
turf renovation	x	x	x	x	x	x	x	x	x

NOTES: Weed control ratings are given as 0–9 where 0 indicates no control and 9 indicates 90%–100% control under ideal conditions. Ratings are subjective values based on best available information and give general comparisons based on use as described in this guide. Under unfavourable conditions (e.g., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated. Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used. Always refer to the product label for more information on registered weed species, product uses and precautions.

TABLE 6–2. Preplant Herbicide Weed Control Ratings

LEGEND: Numbers (0–9) = weed control ratings ✓ = species is controlled if emerged – = insufficient information available to make a rating

	Annuals		Perennials														
Trade Name	annual grasses	annual broadleaves	bindweed, field	chickweed, mouse-eared	dandelion	goldenrod	ground-ivy (creeping charlie)	horsetail	mallow	milkweed	nutsedge	plantains	poison ivy	quackgrass	sow-thistle	thistle, Canada	vetches
Preplant Herbicides																	
AIM EC	–	✓	–	–	–	–	–	–	8	–	–	–	–	–	–	–	–
ERAGON LQ[1]	✓	✓	✓[1]	9	7/8[2]	–	–	✓[3]	–	✓[1]	–	–	–	0	✓[3]	✓[3]	✓[3]
glyphosate[4]	✓	✓	✓[1]	9	7/8[2]	–	5	0	5	✓[1]	7	9	8	8/9	✓[1]	✓[1]	5
GRAMOXONE	✓	✓	✓[3]	✓[3]	✓[3]	–	✓[3]	✓[3]	✓[3]	✓[3]	✓[3]	✓[3]	✓[3]	✓[3]	✓[3]	✓[3]	✓[3]
IGNITE	✓	✓	8[5]	–	6	–	–	7[5]	–	6[5]	7[5]	–	–	8[5]	8[5]	8[5]	–

[1] Optimum growth stages for best control of these weeds will not likely be attained prior to planting in early to mid spring.

[2] Use the 1.8 kg/ha of glyphosate for plants over 15 cm tall or across.

[3] Top growth only, regrowth can be expected.

[4] Numerous products exist. Refer to Table 4–1. Herbicides Used in Ontario, page 30 for a complete list of products.

[5] Repeated applications may be necessary.

TABLE 6–3. Specific Notes on Weeds Controlled and Product Rates Associated with Various Glyphosate Concentrations

LEGEND: * = Numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, page 30 for a complete list of products.

Glyphosate* Concentration	Product Rate/acre	Weeds Controlled & Notes
360 g/L	0.75 – 3.5 L/ha (0.3–1.4 L/acre)	· For control of **annual weeds**. · Apply in 50–100 L/ha (20–40 L/acre) of water, or use surfactant with larger water volumes. · The highest rate is required for weeds over 15 cm in height. · For weeds smaller than 15 cm in height consult the product label for weed specific rates. · For actively growing weeds in the fall, or spring prior to emergence of any crop. · Allow 5–7 days translocation time after application before doing any tillage when conditions are good. If cool temperatures follow application, allow additional time for translocation to be completed before disturbing treated weeds. · Only weeds emerged at application time will be controlled.
450 g/L	0.6 – 2.8 L/ha (0.24–1.12 L/acre)	
480 g/L	0.55 – 2.6 L/ha (0.22–1.05 L/acre)	
500 g/L	0.55 – 2.5 L/ha (0.22–1 L/acre)	
540 g/L	0.5 – 2.3 L/ha (0.2–0.93 L/acre)	
360 g/L	2.5 – 7 L/ha (1–2.8 L/acre)	· For **dandelions** and **quackgrass**. · Apply when quackgrass has 3–4 new leaves. · The low rate will provide a minimum of one season control while higher rates will provide longer term control of quackgrass. · For dandelions, apply the low rate if smaller than 15 cm in diameter and higher rates if greater than 15 cm in diameter.
450 g/L	2 – 5.6 L/ha (0.8–2.25 L/acre)	
480 g/L	1.88 – 5.25 L/ha (0.75–2.1 L/acre)	
500 g/L	1.8 – 5 L/ha (0.72–2 L/acre)	
540 g/L	1.67 - 4.68 L/ha (0.67–1.87 L/acre)	

TABLE 6–4. Herbicide Treatment Rates for Preplant Weed Control

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Preplant – Site Preparation Prior To Any Crop			
carfentrazone-ethyl (8.9–28 g/ha) + non-ionic surfactant (0.25% v/v)	AIM EC (240 g/L) + AGRAL 90 AIM EC (240 g/L) + AG-SURF	37–117 mL/ha (5–47 mL/acre) + 2.5 L/1,000 L	• Apply to actively growing weed up to 10 cm tall. • Coverage of the weeds is essential for good control.
carfentrazone-ethyl (8.9–28 g/ha) + surfactant/solvent (0.1 % v/v)	AIM EC (240 g/L) + MERGE	37–117 mL/ha (5–47 mL/acre) + 1 L/1,000 L	
saflufenacil (25.2–49.7–101.1 g/ha) + glyphosate (0.9 kg/ha) + MERGE (1 L/ha)	ERAGON (70%) + glyphosate (360 g/L) + MERGE	36–71–143 g/ha (14.6–29–58.4 g/acre) + 2.5 L/ha (1 L/acre) + 1 L/ha (0.4 L/acre)	• SOYBEANS: **Do NOT** apply more than the 36 g/ha (14.6 g/acre) rate of ERAGON or the 73 mL/ha (29.5 mL/acre) of ERAGON LQ. Apply as a surface application up to 21 days before planting. • CEREALS: **Do NOT** apply more than the 71 g/ha (29 g/acre) rate of ERAGON or 145 mL/ha (58 mL/acre) of ERAGON LQ. • CORN: Apply between 71 g/ha (29 g/acre) and 143 g/ha (58.4 g/acre) of ERAGON or between 145 mL/ha (58 mL/acre) and 295 mL/ha (118 mL/acre) of ERAGON LQ. Apply before crop emergence. The low rate will only provide limited residual weed control.
	ERAGON LQ + glyphosate (360 g/L) + MERGE	73–145–295 mL/ha (29.5–58–118 mL/acre) +2.5 L/ha (1 L/acre) + 1 L/ha (0.4 L/acre)	
2,4-D choline/ glyphosate (2,4-D: 427 – 640 g/ha) (glyphosate: 449 – 673 g/ha)	ENLIST DUO (194 + 204 g/L)	2.2 – 3.3 L/ha (0.88 – 1.32 L/acre)	• Apply before or after planting but before emergence of wheat, barley, rye and field corn. • The low rate controls sensitive weeds up to 8 cm in height. • The high rate controls sensitive weeds up to 15 cm in height.
glyphosate (0.27–4.32 kg/ha)	glyphosate*	Refer to Table 6–3.	• For specific information on product rate and notes for annual and perennial weed control, refer to Table 6–3. Specific Notes on Weeds Controlled and Product Rates Associated with Various Glyphosate Concentrations, page 94. * Numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, page 30 for a complete list of products.
paraquat (0.55–1.1 kg/ha)	GRAMOXONE (200 g/L)	2.75–5.5 L/ha (1.1–2.2 L/acre)	• Apply to actively growing vegetation at least 3 days prior to crop emergence. • Use the high rate when weeds are above 5 cm in height. • Apply in 300–1,100 L/ha water (120–440 L/acre). • Complete coverage is important. Use higher water volumes on dense vegetation. • Perennial weeds will only be suppressed. • Only emerged weeds will be controlled.
paraquat (0.5 kg/ha)	GRAMOXONE (200 g/L)	2.5 L/ha (1 L/acre)	• For use as a preplant burndown before no-till corn and soybean. • Apply to actively growing vegetation at least 3 days prior to crop emergence. • Apply in 200–250 L/ha water (80–100 L/acre). • Complete coverage is important. Use higher water volume on dense vegetation. • Perennial weeds will only be suppressed.

TABLE 6–4. Herbicide Treatment Rates for Preplant Weed Control (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Stale Seedbed and Inter-Row Weeding			
The stale seedbed technique is useful when the soil can be worked well before planting and weeds are allowed to emerge for several weeks. Apply one of the non-selective postemergent herbicides listed here to kill emerged weeds. Seeding or planting directly into the killed weeds with minimal soil disturbance will allow the crop to establish before the next flush of weed emergence. Follow up with either cultivation, hoeing or postemergent or directed herbicides to control later germinating weeds. Where registered, some herbicides can be applied after seeding but before crop emergence.			
carfentrazone-ethyl (8.9–28 g/ha) + non-ionic surfactant (0.25% v/v)	AIM EC (240 g/L) + non-ionic surfactant	37–117 mL/ha (5–47 mL/acre) + 2.5 L/1,000 L	· Apply POST with a hooded sprayer between the rows or between the plastic mulch. · Apply to actively growing weeds up to 10 cm tall. · Apply in a minimum of 100 L/ha (40 L/acre) water. · Apply ONLY once per growing season. · AIM EC may cause crop injury if the spray is allowed to come in contact with the green stem, leaves, bloom or fruit. · Pre-Harvest Interval (PHI) ranges from 1–15 days depending on the crop. Refer to the product label for a specific crop's PHI. · Refer to product label or Chapter 4, Notes on Herbicides, page 40 for a list of registered crop uses.
carfentrazone-ethyl (8.9–28 g/ha) + surfactant solvent (0.1 % v/v)	AIM EC (240 g/L) + MERGE	37–117 mL/ha (5–47 mL/acre) + 1 L/1,000 L	
glyphosate (0.27–4.32 kg/ha)	glyphosate	See Table 6–3.	· Till and fertilize soil in early spring. · Allow weeds to grow, and spray weeds just before seeding crop. · For specific information on product rate and notes for annual and perennial weed control, refer to Table 6–3. Specific Notes on Weeds Controlled and Product Rates Associated with Various Glyphosate Concentrations, page 94. * Numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, page 30 for a complete list of products.
paraquat (0.6–1.1 kg/ha)	GRAMOXONE (200 g/L)	3–5.5 L/ha (1.2–2.2 L/acre)	· For emerged weeds after the crop seed is sown, but before crop emergence. · For use only in beans (all types), beets, carrots, cole crops, corn, onions, peas, cucumbers, potatoes, soybeans and turnips. · In inter-row weeding, special low pressure equipment is used to apply the herbicide on emerged weeds without contact with leaves of the crop plants. · For small areas, apply 30 mL product in 10 L water per 100 m^2.
diquat (0.55–1.1 kg/ha)	REGLONE (240 g/L)	2.3–4.6 L/ha (0.92–1.84 L/acre)	
glufosinate ammonium (0.405–0.75 kg/ha)	IGNITE (150 g/L)	2.7–5 L/ha (1.08–2 L/acre)	· For use only in carrot, lettuce and onion crops. · Apply in a minimum of 110–330 L/ha (44–132 L/acre) of water. · Apply after seeding, but prior to emergence of the crop.

NOTES: Weed control ratings are given as 0–9 where 0 indicates no control and 9 indicates 90%–100% control under ideal conditions. Ratings are subjective values based on best available information and give general comparisons based on use as described in this guide. Under unfavourable conditions (e.g., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated. Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used. Always refer to the product label for more information on registered weed species, product uses and precautions.

TABLE 6–5. Postharvest Weed Control Ratings

LEGEND: – = insufficient information available to make a rating
** = Use higher rates for weeds larger than 15 cm tall or across.
* = Various products available, see Table 4–1. Herbicides Used in Ontario, page 30.

		Grasses		**Perennial Broadleaf Weeds**									
Crop Stubble	**Treatment**	**quackgrass**	**wire stem muhly**	**bindweed, field**	**chickweed, mouse-eared**	**coltsfoot**	**clover, red**	**dandelion**	**hemp dogbane**	**milkweed**	**ground cherry**	**thistle, Canada**	**sow-thistle**
Postharvest Herbicides													
glyphosate	glyphosate*	9	9	9	9	8	8	8/9**	8	8	7	9	9
dicamba	BANVEL II, ORACLE	0	0	8	9	7	9	8	8	7	6	8	9
diflufenzopyr/dicamba	DISTINCT 70WG	0	0	8	9	7	9	8	8	7	6	8	9
2,4-D	2,4-D*	0	0	7	2	–	5	7	–	0	–	6	7

TABLE 6–6. Specific Notes on Weeds Controlled and Product Rates Associated with Various Glyphosate Concentrations

LEGEND: * = Numerous products exist, refer to Table 4–1. *Herbicides Used in Ontario*, page 30, for a complete list of products.

Glyphosate* Concentration	Product Rate/acre	Weeds Controlled & Notes
360 g/L	0.75 – 3.5 L/ha (0.3–1.4 L/acre)	· For control of **annual weeds.** · Apply in 50–100 L/ha (20–40 L/acre) of water, or use surfactant with larger water volumes. · The highest rate is required for weeds over 15 cm in height. · For weeds smaller than 15 cm in height consult the product label for weed specific rates. · For actively growing weeds in the fall, or spring prior to emergence of any crop. · Allow 5–7 days translocation time after application before doing any tillage when conditions are good. If cool temperatures follow application, allow additional time for translocation to be completed before disturbing treated weeds. · Only weeds emerged at application time will be controlled.
450 g/L	0.6 – 2.8 L/ha (0.24–1.12 L/acre)	
480 g/L	0.55 – 2.6 L/ha (0.22–1.05 L/acre)	
500 g/L	0.55 – 0.2.5 L/ha (0.22–1 L/acre)	
540 g/L	0.5 – 2.3 L/ha (0.2–0.93 L/acre)	
360 g/L	2.5 – 7 L/ha (1–2.8 L/acre)	· For **dandelions** and **quackgrass**. · Apply when **quackgrass** has 3–4 new leaves. · The low rate will provide a minimum of one season control while higher rates will provide longer term control of quackgrass. · For dandelions, apply the low rate if smaller than 15 cm in diameter and higher rates if greater than 15 cm in diameter.
450 g/L	2 – 5.6 L/ha (0.8–2.25 L/acre)	
480 g/L	1.88 – 5.25 L/ha (0.75–2.1 L/acre)	
500 g/L	1.8 – 5 L/ha (0.72–2 L/acre)	
540 g/L	1.67 – 4.68 L/ha (0.67–1.87 L/acre)	
360 g/L	7 – 12 L/ha (2.8–4.8 L/acre)	· For **perennial broadleaf weeds**. · **Canada thistle** and **sow-thistle** should be at least in early bud, milkweed at bud, bindweed at full flower and **dogbane** past full bloom for best results. · For undisturbed perennials (such as in sod or non-crop areas) use the highest rate and repeat when the plants re-grow to the optimum growth stages mentioned above.
450 g/L	5.6 – 9.6 L/ha (2.25–3.85 L/acre)	
480 g/L	5.25 – 9 L/ha (2.1–3.6 L/acre)	
500 g/L	5 – 8.75 L/ha (2–3.5 L/acre)	
540 g/L	4.68 – 8 L/ha (1.87–3.2 L/acre)	

TABLE 6–7. Herbicide Treatment Rates for Postharvest Weed Control

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 40, and Chapter 5, Notes on Adjuvants, page 81.
Postharvest (Broadleaf Herbicides)			
dicamba (1.2 kg/ha)	BANVEL II (480 g/L)	2.5 L/ha (1 L/acre)	• Apply in the fall to actively growing vegetation at least 2 weeks prior to a killing frost. • **Do NOT** apply before fall seeded crops. • Only cereals, soybeans, field corn, sweet corn or white beans may be grown in the year after application.
	ORACLE (480 g/L)		
	HAWKEYE (480 g/L)		
2,4-D (0.85–1.655 kg/ha)	2,4-D ESTER 600* (564 g/L)	1.5–2.9 L/ha (0.6–1.16 L/acre)	• Apply in the fall at the time of rapid growth. • Use the higher rate for legumes and perennial weeds. • For best results apply to actively growing vegetation at least 2 weeks before a killing frost. • **Do NOT** apply before fall wheat or barley. * Numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, page 30, for a complete list of products.
	2,4-D ESTER 700* (660 g/L)	1.29–2.5 L/ha (0.52–1.0 L/acre)	
Postharvest (Grass and Broadleaf Herbicides)			
dicamba (0.6 kg/ha) + glyphosate (0.6 kg/ha) + non-ionic surfactant (0.35 L/ha)	BANVEL II (480 g/L) + glyphosate* + non-ionic surfactant	1.25 L/ha (0.5 L/acre) + (see note in Precautions) + 0.35 L/ha (0.14 L/acre)	• Apply to actively growing vegetation at least 2 weeks prior to a killing frost. • For the control of red clover, volunteer cereals and annual broadleaf weeds. • **Do NOT** apply before fall seeded crops. **NOTE:** Glyphosate Product Rate Equivalents to 0.6 kg/ha active ingredient: • glyphosate (360 g/L): 1.7 L/ha (0.68 L/acre) • glyphosate (450 g/L): 1.33 L/ha (0.53 L/acre) • glyphosate (480 g/L): 1.25 L/ha (0.5 L/acre) • glyphosate (500 g/L): 1.2 L/ha (0.48 L/acre) • glyphosate (540 g/L) : 1.11 L/ha (0.44 L/acre) * Numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, page 30, for a complete list of products.
	ORACLE (480 g/L) + glyphosate* + non-ionic surfactant		
	HAWKEYE (480 g/L) + glyphosate* + non-ionic surfactant		
diflufenzopyr/dicamba (100–200 g/ha) + glyphosate (900 g/ha) + surfactant/solvent	DISTINCT (70 WG) + glyphosate (540 g/L) + MERGE	143–285 g/ha (58–115 L/acre) + 1.34 L/ha (0.67 L/acre) + 0.5 L/ha (0.2 L/acre)	• Apply to actively growing vegetation at least 2 weeks prior to a killing frost. • For the control of red clover, volunteer cereals and annual broadleaf weeds. • **Do NOT** apply before fall seeded crops.
	DISTINCT (70 WG) + glyphosate (540 g/L) + a non-ionic surfactant	143–285 g/ha (58–115 L/acre) + 1.34 L/ha (0.67 L/acre) + 0.25% v/v	
glyphosate (0.27–4.32 kg/ha)	glyphosate*	See Table 6–3.	• For specific information on product rate and notes for annual and perennial weed control, refer to Table 6–3. Specific Notes on Weeds Controlled and Product Rates Associated with Various Glyphosate Concentrations, page 94. * Numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, page 30, for a complete list of products.

TABLE 6–7. Herbicide Treatment Rates for Postharvest Weed Control (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 40, and Chapter 5, Notes on Adjuvants, page 81.
Spot Treatments with Hand-Held Equipment			
glyphosate (0.36–0.72 kg/100 L)	glyphosate (360 g/L)*	1 L–2 L/100 L	· For actively growing weeds. Direct spray to avoid desirable vegetation. · Allow 5–7 days translocation time after application before doing any mowing or tillage when conditions are good. If cool temperatures follow application, allow additional time for translocation to be completed before disturbing treated weeds. · Canada thistle and sow-thistle should be at least in early bud, milkweed at bud, bindweed at full flower, and dogbane past full bloom, and quackgrass with 3–4 new leaves for best results. * Numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, page 30, for a complete list of products.
	glyphosate (450 g/L)*	0.8–1.6 L/100 L	
	glyphosate (480 g/L)*	0.75–1.5 L/100 L	
	glyphosate (500 g/L)*	0.72–1.44 L/100 L	
	glyphosate (540 g/L)*	0.67–1.34 L/100 L	
Wick Wiper and Roller Application			
glyphosate (0.36 kg/2 L water)	glyphosate (360 g/L)*	1 L/2 L water	· Wick wiper applications for use on soybeans, white beans, apple, cherry, peach, pear, plum, grape, strawberries and cranberries. · Apply to weeds that extend above the crop sufficiently to allow good contact with the application equipment. • **Do NOT** contact the crop with the equipment or allow the chemical solution to drip from the applicator onto the crop. · A 33% herbicide mixture (1 L/2 L of water) provides good control of most weeds. * Numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, page 30, for a complete list of products.
	or glyphosate (450 g/L)*	0.8 L/2 L water	
	or glyphosate (480 g/L)*	0.75 L/2 L water	
	or glyphosate (500 g/L)*	0.72 L/2 L water	
	or glyphosate (540 g/L)*	0.67 L/2 L water	

7. BEANS (ADZUKI, DRY COMMON, LIMA & SNAP)

NOTE: Weed control ratings are given as 0–9 where 0 indicates no control and 9 indicates 90%–100% control under ideal conditions. Ratings are subjective values based on best available information and give general comparisons based on use as described in this guide. Under unfavourable conditions (e.g., too dry, too wet, too cold or poor application), the herbicides may not be as effective as indicated. Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used. Always refer to the product label for more information on registered weed species, product uses and precautions.

TABLE 7–1. Herbicide Weed Control Ratings for Beans (Adzuki, Dry, Lima and Snap)

LEGEND: Numbers (0–9) = weed control ratings
✓ = can be used on this crop
R = populations resistant to this herbicide treatment exist in Ontario and won't be adequately controlled if present.

Crop tolerance ratings: E = Excellent, G = Good, F = Fair, P = Poor
x = not indicated for use on this crop

– = insufficient information available to make a rating

	Crop Registrations												Annual Grasses								Annual Broadleaves										Perennials							
Trade Name	**adzuki beans**	**black beans[1]**	**Dutch brown[1]**	**cranberry beans[1]**	**kidney beans[1]**	**lima beans**	**otebo beans[1]**	**pinto beans[1]**	**small red Mexican[1]**	**snap beans[1]**	**yellow eye[1]**	**white beans[1]**	**barnyard grass**	**crabgrass**	**fall panicum**	**foxtail, giant**	**foxtail, green**	**foxtail, yellow**	**proso millet**	**witchgrass**	**buckwheat, wild**	**fleabane, Canada**	**lady's-thumb**	**lamb's-quarters**	**mustards**	**nightshades, annual**	**pigweeds**	**ragweed, common**	**ragweed, giant**	**velvetleaf**	**bindweed, field**	**horsetail**	**milkweed**	**nutsedge**	**quackgrass**	**sow-thistle**	**thistle, Canada**	**Crop Tolerance**
Preplant Incorporated Grass Herbicides																																						
DUAL II MAGNUM	x	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	9	9	8^2	8	9	9	4	9	2	0	2	7	2	8^3	7	4	3	2	0	0	0	8	0	0	0	G
EPTAM	x	✓	✓	✓	✓	x	x	✓	x	✓	✓	✓	9	9	8	9	9	9	7	9	4	0	7	7	5	7	7	5	3	5	–	–	–	8	5	–	–	E
FRONTIER MAX	x	✓	✓	✓	✓	x	✓	✓	✓	✓	✓	✓	9	9	8^2	8	9	9	4	9	2	0	2	7	2	8^3	7	4	3	2	0	0	0	8	0	0	0	G
PROWL H2O	✓	x	x	x	✓	✓	x	x	x	✓	x	✓	9	9	9	8	8	8	5	–	–	–	–	7	–	–	8	–	–	–	–	–	–	–	–	–	–	E
RIVAL **or** TREFLAN **or** BONANZA	x	✓	x	x	✓	✓	x	x	x	x	x	✓	9	9	9	9	9	9	7	9	5	0	2	8	2	2	8	2	1	2	2	2	2	2	2	2	2	E
Preplant Incorporated Grass and Broadleaf Herbicides																																						
PURSUIT **or** PHANTOM **or** NU-IMAGE	✓	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	8	7	7	9^R	9^R	9	7	8	8	2	9	9^R	9	9^R	9^R	7^R	6^R	9	2	2	2	7	6	2	2	G

[1] Indicates a *Phaseolus vulgaris* dry common bean.
[2] Use the high rate of herbicide for optimum control.
[3] Use PRE timing for optimum control.
[4] Use PPI timing for optimum control.

TABLE 7–1. Herbicide Weed Control Ratings for Beans (Adzuki, Dry, Lima and Snap) (cont'd)

LEGEND: Numbers (0–9) = weed control ratings Crop tolerance ratings: E = Excellent, G = Good, F = Fair, P = Poor – = insufficient information available to make a rating
✓ = can be used on this crop x = not indicated for use on this crop
R = populations resistant to this herbicide treatment exist in Ontario and won't be adequately controlled if present.

	Crop Registrations												**Annual Grasses**								**Annual Broadleaves**											**Perennials**							
Trade Name	**adzuki beans**	**black beans[1]**	**Dutch brown[1]**	**cranberry beans[1]**	**kidney beans[1]**	**lima beans**	**otebo beans[1]**	**pinto beans[1]**	**small red Mexican[1]**	**snap beans[1]**	**yellow eye[1]**	**white beans[1]**	**barnyard grass**	**crabgrass**	**fall panicum**	**foxtail, giant**	**foxtail, green**	**foxtail, yellow**	**proso millet**	**witchgrass**	**buckwheat, wild**	**fleabane, Canada**	**lady's-thumb**	**lamb's-quarters**	**mustards**	**nightshades, annual**	**pigweeds**	**ragweed, common**	**ragweed, giant**	**velvetleaf**	**bindweed, field**	**horsetail**	**milkweed**	**nutsedge**	**quackgrass**	**sow-thistle**	**thistle, Canada**	**Crop Tolerance**
Preplant Incorporated Tank-Mixes																																						
DUAL II MAGNUM + (PURSUIT **or** PHANTOM **or** NU-IMAGE)	x	✓	✓	✓	✓	x	✓	✓	✓	✓	✓	✓	9	9	8^2	9	9	9	7	9	8	2	9	9^R	9	9	9	7^R	6^R	9	–	–	–	8	7	–	–	E
EPTAM + (RIVAL **or** TREFLAN **or** BONANZA)	x	x	x	x	✓	x	x	x	x	x	x	✓	9	9	9	9	9	9	7	9	5	5	7	8	5	8	8	5	3	5	–	–	–	8	7	–	–	E
FRONTIER MAX + PURSUIT	x	✓	✓	✓	✓	x	✓	✓	✓	✓	✓	✓	9	9	8^2	9	9	9	7	9	8	2	9	9^R	9	9	9	7^R	6^R	9	–	–	–	8	7	–	–	E
(PURSUIT **or** PHANTOM **or** NU-IMAGE) + (RIVAL **or** TREFLAN **or** BONANZA)	x	x	x	x	x	x	x	x	x	x	x	✓	9	9	9	9	9	9	7	9	8	5	9	9	9	9^R	9	7^R	6^R	9	2	2	2	7	6	2	2	G
Preemergence Grass Herbicides																																						
DUAL II MAGNUM	x	✓	✓	✓	✓	x	✓	✓	✓	x	✓	✓	9	9	8^2	8	9	9	4	9	2	0	2	7	2	8	7	4	3	2	0	0	0	7^4	0	0	0	G
Preemergence Broadleaf Herbicides																																						
PERMIT	x	✓	✓	✓	✓	x	✓	✓	✓	✓	✓	✓	–	–	–	–	–	–	–	–	–	8^R	8	8	8	2	8^R	8^R	8^R	8^R	6	6	7	9	–	–	–	E
Preemergence Grass and Broadleaf Herbicides																																						
PURSUIT **or** PHANTOM **or** NU-IMAGE	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	8	7	7	9^R	9^R	9	7	8	8	2	9	9^R	9	9^R	9^R	7^R	6^R	9	2	2	2	7	6	2	2	G

[1] Indicates a *Phaseolus vulgaris* dry common bean.
[2] Use the high rate of herbicide for optimum control.
[3] Use PRE timing for optimum control.
[4] Use PPI timing for optimum control.

TABLE 7–1. Herbicide Weed Control Ratings for Beans (Adzuki, Dry, Lima and Snap) (cont'd)

LEGEND: Numbers (0–9) = weed control ratings
✓ = can be used on this crop
R = populations resistant to this herbicide treatment exist in Ontario and won't be adequately controlled if present.
Crop tolerance ratings: E = Excellent, G = Good, F = Fair, P = Poor
x = not indicated for use on this crop
– = insufficient information available to make a rating

	Crop Registrations												Annual Grasses								Annual Broadleaves										Perennials							
Trade Name	**adzuki beans**	**black beans[1]**	**Dutch brown[1]**	**cranberry beans[1]**	**kidney beans[1]**	**lima beans**	**otebo beans[1]**	**pinto beans[1]**	**small red Mexican[1]**	**snap beans[1]**	**yellow eye[1]**	**white beans[1]**	**barnyard grass**	**crabgrass**	**fall panicum**	**foxtail, giant**	**foxtail, green**	**foxtail, yellow**	**proso millet**	**witchgrass**	**buckwheat, wild**	**fleabane, Canada**	**lady's-thumb**	**lamb's-quarters**	**mustards**	**nightshades, annual**	**pigweeds**	**ragweed, common**	**ragweed, giant**	**velvetleaf**	**bindweed, field**	**horsetail**	**milkweed**	**nutsedge**	**quackgrass**	**sow-thistle**	**thistle, Canada**	**Crop Tolerance**
Preemergence Tank-Mixes																																						
DUAL II MAGNUM + (PURSUIT **or** PHANTOM **or** NU-IMAGE)	x	x	x	✓	✓	x	x	x	x	x	x	x	9	9	8[2]	9	9	9	7	9	8	2	9	9^{R}	9	9	9	7^{R}	6^{R}	9	–	–	–	8[4]	7	–	–	E
PERMIT + EPTAM	x	✓	✓	✓	✓	x	x	✓	x	✓	✓	✓	9	9	8	9	9	9	7	9	4	8^{R}	8	8	8	7	8^{R}	8^{R}	8^{R}	8^{R}	6	6	7	9	5	–	–	E
Postemergence Grass Herbicides																																						
ASSURE II **or** YUMA GL	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	9	8	9	9	9	8	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	E
EXCEL SUPER	x	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	9	8	9	9	9	8	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	E
POAST ULTRA	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	9	8	9	9	9	9	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	E
SELECT **or** ARROW	x	✓	✓	✓	✓	x	✓	✓	✓	✓	✓	✓	9	8	9	9	9	9	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	E
VENTURE L	✓	✓	✓	✓	✓	x	✓	✓	✓	x	✓	✓	9	8	9	8	8	9	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	E
Postemergence Broadleaf Herbicides																																						
BASAGRAN	x	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	0	0	0	0	0	0	0	7	5	9	7	9	7	7	8	6	9	6	2	2	8	0	5	7	G
BASAGRAN FORTÉ	x	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	0	0	0	0	0	0	0	7	5	9	7	9	7	7	8	6	9	6	2	2	8	0	5	7	G
REFLEX	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	0	0	0	0	0	0	0	0	8	2	8	6	9	8	9	9	7	6	3	6	2	–	0	5	3	F
Postemergence Tank-Mixes																																						
EXCEL SUPER + BASAGRAN	x	x	x	x	✓	x	x	✓	x	x	x	✓	9	8	9	9	9	8	9	9	7	5	9	7	9	7	7	8	6	9	5	2	2	8	1	5	7	G
BASAGRAN + REFLEX	x	x	x	x	✓	x	x	x	x	x	x	✓	0	0	0	0	0	0	0	0	8	5	9	7	9	8	9	9	7	9	5	2	2	8	1	5	7	F
REFLEX + VENTURE	✓	✓	✓	✓	✓	x	✓	✓	✓	✓	✓	✓	9	8	9	8	8	9	9	9	8	2	8	6	9	8	9	9	7	6	3	6	2	–	0	5	3	F

[1] Indicates a *Phaseolus vulgaris* dry common bean.
[2] Use the high rate of herbicide for optimum control.
[3] Use PRE timing for optimum control.
[4] Use PPI timing for optimum control.

Beans (Adzuki, Dry, Lima and Snap)

Dry beans (*Phaseolus vulgaris*) include black, cranberry, Dutch brown, kidney, mung, otebo, pinto, snap, small red Mexican, yellow eye and white bean market classes.

Apply all treatments in 150–300 L/ha (60–120 L/acre) water, unless otherwise specified.

When developing a weed control program, consider cultivation, rotation and other cultural practices along with herbicide treatments. Any single method of weed control, or the continuous use of the same chemical, can lead to the build-up of weeds resistant or tolerant to that control method. Rotating crops and/or other control methods reduce the chance of developing new or unique weed infestations.

High speed (10–20 km/h), shallow (2.5–3 cm) cultivation with a rotary hoe when beans are in the 1–2-leaf stage helps control small weed seedlings. This technique does not reduce herbicide action and may, in some years, enhance chemical weed control and improve crop safety.

Inter-row cultivation may be needed when weeds escape herbicide treatment. Consider weeds "escapes" when they are 5–7 cm high. Shallow cultivation will control the escaped weeds and prevents newly germinated ones from surviving.

Band treatment of chemical over the row reduces costs by one-half to two-thirds, depending on row spacing and width of band. Shallow inter-row cultivation will be required to control weeds between the bands.

Cultivation will give some control of established perennial weeds but may also help spread them to previously uninfested areas. Machinery sanitation is important when moving from one field to another.

Please refer to Table 7–1. *Herbicide Weed Control Ratings for Beans (Adzuki, Dry, Lima and Snap)*, page 101, to determine which market classes of edible beans are registered for the herbicide treatments listed.

Rates and application techniques vary for trifluralin products. For further information on these and other chemicals, see the label recommendations and also *Notes on Herbicides*, page 40.

Herbicide Application Timings

- **Preplant (PP)** – Also see *Chapter 6 Preplant & Postharvest Weed Control*, page 91, for details of products, rates and remarks.

- **Preplant Incorporated (PPI)** – Unless stated otherwise, two incorporations at right angles operating at a depth of 10 cm using a double disk (7–10 km/h) or vibrating shank S-tine cultivator (10–13 km/h) are required. Cultivation equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Pay special attention to machinery cleanliness and/or treating fields with perennial weeds last.

- **Preemergence (PRE)** – Rainfall of 15–20 mm within 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall.

- **Postemergence (POST)** – Leaf stage of the weeds is critical for good weed control. Smaller weeds are usually more sensitive to herbicide injury. Apply according to labelled leaf stages. Crop stage is important to optimize crop safety. Adjuvants will frequently improve the weed control when used as directed. Weather or other conditions may influence the optimum rate of adjuvant. See the product label for more details. Always use appropriate drift management technology.

- **Preharvest** – It is important to follow the correct pre harvest interval (PHI), use rates and appropriate crop staging provided on the product label of pre harvest treatments so as to ensure a quality, marketable dry bean crop that is easy to harvest.

TABLE 7–2. Herbicide Treatment Rates for Beans (Adzuki, Dry, Lima and Snap)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see *Notes on Herbicides*, page 40.
Soil-Applied Grass Herbicides			
s-metolachlor/benoxacor (1.05–1.6 kg/ha)	DUAL II MAGNUM (915 g/L)	1.15–1.75 L/ha (0.46–0.7 L/acre)	• Apply PPI or PRE on all dry common bean (*Phaseolus vulgaris*) market classes. • DUAL II MAGNUM must be applied PPI to lima beans. **Do NOT** apply PRE to lima beans. • Apply PPI to minimize the potential for crop injury. • **Do NOT** use on adzuki beans. • **Do NOT** use on muck, peat or high organic matter soils. • Use the low rate on coarse-textured soils low in organic matter. • Requires rainfall for activation. Rotary hoe if no rainfall occurs within 7 days. • Improved yellow nutsedge control is obtained when DUAL MAGNUM is applied PPI. • Use the higher rate for the control of nightshade.
EPTC (3.4–4.4 kg/ha)	EPTAM (800 g/L)	4.25–5.5 L/ha (1.7–2.2 L/acre)	• Apply PPI. Incorporate immediately. • **Do NOT** use on adzuki, lima, otebo and small red Mexican beans. • If dry weather has preceded the application of EPTC, delay seeding 7–10 days. • Temporary injury can occur in the emerging crop. • Use the high rate for nutsedge control.
dimethenamid-P (544–693 g/ha)	FRONTIER MAX (720 g/L)	756–963 mL/ha (305–390 mL/acre)	• Apply PPI on all dry common bean (*Phaseolus vulgaris*) market classes. • Minimum PPI rate is 860 mL/ha (348 mL/acre). • **Do NOT** use on adzuki and lima beans. • **Do NOT** use on muck, peat or high organic matter soils. • Use the low rate on coarse-textured soils low in organic matter. • Use the higher rate of FRONTIER MAX for the control of nightshade and pigweed. • Requires rainfall for activation. Rotary hoe if no rainfall occurs within 7 days.
pendimethalin (1.08 kg/ha)	PROWL H2O (455 g/L)	2.37 L/ha (0.95 L/acre)	• PPI **ONLY**. • **Do NOT** harvest adzuki beans within 90 days of application, snap beans within 50 days of application and lima beans within 80 days of application.
trifluralin (0.6–1.155 kg/ha)	TREFLAN EC (480 g/L)	1.25–2.4 L/ha (0.5–0.96 L/acre)	• Apply PPI. Incorporate as soon as possible, within 24 hr. • **Do NOT** use on adzuki, Dutch brown, cranberry, otebo, pinto, small red Mexican, snap and yellow-eye beans. • **Do NOT** exceed 1.25 L/ha (0.5 L/acre) of trifluralin (480 g/L) on medium-textured soils and 1.7 L/ha (0.68 L/acre) on heavy-textured soils for lima beans.
	RIVAL (500 g/L)	1.2–2.3 L/ha (0.48–0.92 L/acre)	
	BONANZA 480 (480g/L)	1.25–2.4 L/ha (0.5–0.96 L/acre)	
Soil-Applied Grass and Broadleaf Herbicides			
halosulfuron (26.25–35.25 g/ha)	PERMIT (72.6%)	35–47 g/ha (14–19 g/acre)	• Apply PRE after seeding but prior to soil cracking. Use the lower rate on lighter textured soils with low organic matter.
imazethapyr (0.075 kg/ha)	PURSUIT (240 g/L)	0.312 L/ha (0.126 L/acre)	• Apply PPI or PRE to adzuki and all dry bean (*Phaseolus vulgaris*) market classes. • PURSUIT or PHANTOM must be applied PRE to lima beans. **Do NOT** apply PPI to lima beans. • Delayed maturity or stunting may occur if cold and/or wet conditions are experienced within first week after application. • Requires rainfall for activation. Rotary hoe if no rainfall occurs within 7 days. • **Do NOT** harvest within 100 days of application. • **Some rotational cropping restrictions apply** (see Table 4–4. *Herbicide Crop Rotation and Soil pH Restrictions – Field Crops*, page 74).
	PHANTOM (240 g/L)		
	NU-IMAGE (240 g/L)		

TABLE 7–2. Herbicide Treatment Rates for Beans (Adzuki, Dry, Lima and Snap) (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see *Notes on Herbicides*, page 40.
Soil-Applied Tank-Mixes			
s-metolachlor/benoxacor (1.05–1.60 kg/ha) + imazethapyr (0.075 kg/ha)	DUAL II MAGNUM (915 EC) + PURSUIT (240 g/L)	1.15–1.75 L/ha (0.46–0.7 L/acre) + 0.312 L/ha (0.126 L/acre)	· Apply PRE **ONLY** to cranberry or kidney beans. · Apply PPI to all dry common bean (*Phaseolus vulgaris*) market classes. · **Do NOT** use on adzuki and lima beans. · **Do NOT** use on muck, peat or high organic matter soils. · Use the low rate on coarse-textured soils low in organic matter. · Requires rainfall for activation. Rotary hoe if no rainfall occurs within 7 days. · **Do NOT** harvest within 100 days of application. · **Some rotational cropping restrictions apply** (see Table 4–4. *Herbicide Crop Rotation and Soil pH Restrictions – Field Crops*, page 74.
	DUAL II MAGNUM (915 EC) + PHANTOM (240 g/L)		
	DUAL II MAGNUM (915 EC) + NU-IMAGE (240 g/L)		
EPTC (2.4 kg/ha) + trifluralin (0.6 kg/ha)	EPTAM (800 g/L) + TREFLAN EC (480 g/L)	3 L/ha (1.2 L/acre) + 1.25 L/ha (0.5 L/acre)	· Apply PPI. Incorporate immediately. · Use **ONLY** on white bean and red kidney bean. · If dry weather has preceded the application of EPTC, delay seeding 7–10 days.
	EPTAM (800 g/L) + RIVAL (500 g/L)	3 L/ha (1.2 L/acre) + 1.2 L/ha (0.48 L/acre)	
	EPTAM (800 g/L) + BONANZA 480 (480 g/L)	3 L/ha (1.2 L/acre) + 1.25 L/ha (0.5 L/acre)	
dimethenamid-P (544–693 g/ha) + imazethapyr (0.075 kg/ha)	FRONTIER MAX (720 g/L) + PURSUIT (240 g/L)	756–963 mL/ha (305–390 mL/acre) + 0.312 L/ha (0.126 L/acre)	· Apply PPI on all dry common bean (*Phaseolus vulgaris*) market classes. · **Do NOT** use on adzuki and lima beans. · **Do NOT** use on muck, peat or high organic matter soils. · Use the low rate on coarse-textured soils low in organic matter. · Requires rainfall for activation. Rotary hoe if no rainfall occurs within 7 days. · **Do NOT** harvest within 100 days of application. · **Some rotational cropping restrictions apply** (see Table 4–4. *Herbicide Crop Rotation and Soil pH Restrictions – Field Crops*, page 74).
halosulfuron (26.25–35.25 g/ha) + EPTC (3.4–4.2 kg/ha)	PERMIT (72.6%) + EPTAM (800 g/L)	35–47 g/ha (14–19 g/acre) + 4.25–5.25 L/ha (1.7–2.1 L/acre)	· Apply PPI to a depth of approximately 5 cm just before planting. · Use lower rate on lighter textured soils with low organic matter. · Refer to EPTAM 8-E label for specific incorporation directions. · Rotary hoe lightly during or shortly after emergence of the beans to break any crust which occurs.
imazethapyr (0.075 kg/ha) + trifluralin (0.6–1.15 kg/ha)	PURSUIT (240 g/L) **or** PHANTOM (240 g/L) **or** NU-IMAGE (240 g/L) + TREFLAN EC (480 g/L)	0.312 L/ha (0.126 L/acre) + 1.25–2.4 L/ha (0.5–0.96 L/acre)	· Apply PPI and incorporate as soon as possible within 24 hr. · Use **ONLY** on white beans. · **Do NOT** harvest within 100 days of application. • **Some rotational cropping restrictions apply** (see Table 4–4. *Herbicide Crop Rotation and Soil pH Restrictions – Field Crops*, page 74).
	PURSUIT (240 g/L) **or** PHANTOM (240 g/L) **or** NU-IMAGE (240 g/L) + RIVAL (500 g/L)	0.312 L/ha (0.126 L/acre) + 1.2–2.3 L/ha (0.48–0.92 L/acre)	
	PURSUIT (240 g/L) **or** PHANTOM (240 g/L) **or** NU-IMAGE (240 g/L) + BONANZA 480 (480 g/L)	0.312 L/ha (0.126 L/acre) + 1.25–2.4 L/ha (0.5–0.96 L/acre)	

TABLE 7–2. Herbicide Treatment Rates for Beans (Adzuki, Dry, Lima and Snap) (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see *Notes on Herbicides*, page 40.
Postemergence Grass Herbicides			
quizalofop-p-ethyl (0.036–0.07 kg/ha) + oil concentrate (0.5% v/v)	ASSURE II (96 g/L) + SURE-MIX YUMA GL (96 g/L) + XA Oil Concentrate	0.38–0.75 L/ha (0.15–0.3 L/acre) + 5 L/1,000 L	• Apply to emerged annual grasses and volunteer cereals in 2-leaf to tillering stage and volunteer corn and quackgrass in the 2–6-leaf stage. • For use on adzuki, lima and all dry common bean (*Phaseolus vulgaris*) market classes. • Use the 0.38 L/ha (0.15 L/acre) rate for control of volunteer corn, volunteer cereals and green foxtail. • The 0.5 L/ha (0.2 L/acre) rate will suppress quackgrass and also control barnyard grass. • Use the 0.75 L/ha (0.3 L/acre) rate for control of quackgrass.
fenoxaprop-p-ethyl (0.054 kg/ha)	EXCEL SUPER (80.5 g/L)	0.67 L/ha (0.27 L/acre)	• Apply POST when annual grasses are in the 2–5-leaf stage. • Apply POST to all dry common bean *(Phaseolus vulgaris)* market classes. • **Do NOT** use on adzuki beans. • **Do NOT** apply if rain is expected within 1 hour after application.
sethoxydim (0.15–0.5 kg/ha) + surfactant (1–2 L/ha)	POAST ULTRA (450 g/L) + MERGE	0.32–1.1 L/ha (0.13–0.45 L/acre) + 1–2 L/ha (0.4–0.8 L/acre)	• Apply POST when annual grasses and volunteer cereals are in the 1–6-leaf stage and quackgrass is in the 1–3-leaf stage. • Apply POST to adzuki, lima and all dry common bean (*Phaseolus vulgaris*) market classes. • Use the intermediate rate of 0.47 L/ha (0.19 L/acre) for volunteer spring cereals. • Use the high rate of 1.1 L/ha (0.45 L/acre) for quackgrass. • Thorough preplant tillage will ensure more uniform quackgrass emergence. Follow with a cultivation 7 days after treatment in wide row crops. • **Do NOT** apply if rain is expected within 1 hour after application.
clethodim (0.03–0.046 kg/ha) + surfactant (0.5% v/v)	SELECT (240 g/L) + AMIGO ARROW (240 g/L) + X-ACT	0.125–0.19 L/ha (0.05–0.076 L/acre) + 5 L/1,000 L	• Apply POST to all dry common bean (*Phaseolus vulgaris*) market classes and when annual grasses and volunteer cereals are in the 1–6-leaf stage. • **Do NOT** apply if rain is expected within 1 hr after application. • **Do NOT** use on adzuki and lima beans. • **Do NOT** harvest within 60 days of application. • For control of quackgrass, apply SELECT or ARROW at 0.38 L/ha (0.152 L/acre) with the appropriate surfactant at 10 L/1,000 L water.
fluazifop-P-butyl (0.075–0.25 kg/ha)	VENTURE L (125 g/L)	0.6–2 L/ha (0.243–0.8 L/acre)	• Apply POST to adzuki and all dry common bean (*Phaseolus vulgaris*) market classes. • **Do NOT** apply to adzuki or dry common beans past the third trifoliate leaf stage. • **Do NOT** use on lima beans. • The 0.6 L/ha (0.243 L/acre) rate is for the control of volunteer corn at the 2–5-leaf stage. • The 1 L/ha (0.4 L/acre) rate is for the control of annual grasses at the 2–4-leaf stage. • The 2 L/ha (0.8 L/acre) rate is for the control of quackgrass or wirestem muhly at the 3–5-leaf stage. • **Do NOT** harvest adzuki and dry beans within 75 days of application.

TABLE 7–2. Herbicide Treatment Rates for Beans (Adzuki, Dry, Lima and Snap) (cont'd)

ACTIVE INGREDIENT (rate)	**TRADE NAME (concentration)**	**PRODUCT RATE**	**PRECAUTIONS For more information, see *Notes on Herbicides*, page 40.**
Postemergence Broadleaf Herbicides			
bentazon (0.84–1.08 kg/ha) + oil concentrate (2 L/ha)	BASAGRAN FORTÉ (480 g/L) + ASSIST BASAGRAN (480 g/L) + ASSIST	1.75–2.25 L/ha (0.7–0.9 L/acre) + 2 L/ha (0.8 L/acre)	· Apply POST when beans are in the unifoliate to 4-trifoliate leaf stage. · Apply POST to all dry common bean (*Phaseolus vulgaris*) market classes. · **Do NOT** use on adzuki beans. · Apply when weeds are small and actively growing. · Two applications of 1.75 L/ha (0.7 L/acre) 10 days apart may be required to control the perennial weeds. · No adjuvant is required with BASAGRAN FORTÉ. · **Do NOT** apply if rain is expected within 6 hr after application.
halosulfuron (26.25–50.82 g/ha)	PERMIT (72.6%)	35–70 g/ha (14–28 g/acre)	· Apply as a directed spray when plants have 2–4 trifoliate leaves and before flowering. Make one broadcast application. Directed sprays are recommended to limit crop injury. · Use a nonionic surfactant (NIS). · Use 35–46.7 g/ha for broadleaved weeds. Where nutsedge is present, use up to 70 g/ha. · Following the final application allow 30 days before harvesting. · Make **ONLY** one PERMIT Herbicide application per crop cycle. Apply either Pre-Emergence or Post-Emergence, but not both. · PERMIT Herbicide will not control ALS resistant weeds. · **Do NOT** apply more than 70 g of PERMIT Herbicide per hectare per season.
fomesafen (0.24 kg/ha) + adjuvant (0.25% v/v)	REFLEX (240 g/L) + AGRAL 90	1 L/ha (0.4 L/acre) + 2.5 L/1,000 L	· Apply POST when beans are in the 1–2 trifoliate leaf stage. · Apply when weeds are small and actively growing. · Apply in 200–350 L water/ha (80–140 L/acre water). · **Do NOT** apply if rain is expected within 4 hr after application. · **Do NOT** apply REFLEX to any field more often than once every 2 years. · **Do NOT** apply to crop under stress. · Some rotational cropping restrictions apply. · **Do NOT** harvest adzuki and dry beans within 84 days of application. · **Do NOT** harvest snap beans within 30 days of application.

TABLE 7–2. Herbicide Treatment Rates for Beans (Adzuki, Dry, Lima and Snap) (cont'd)

ACTIVE INGREDIENT (rate)	**TRADE NAME (concentration)**	**PRODUCT RATE**	**PRECAUTIONS For more information, see *Notes on Herbicides*, page 40.**
Postemergence Tank-Mixes			
bentazon (0.84 kg/ha) + fomesafen (0.14 kg/ha) + oil concentrate (2 L/ha)	BASAGRAN (480 g/L) + REFLEX (240 g/L) + ASSIST	1.75 L/ha (0.7 L/acre) + 0.58 L/ha (0.23 L/acre) + 2 L/ha (0.8 L/acre)	· Apply POST when beans are in the 1–2 trifoliate leaf stage. · Use **ONLY** on white and kidney beans. · Refer to the BASAGRAN label and the REFLEX label for information on specific weed stage and height. · **Do NOT** apply if rain is expected within 6 hr after application.
fenoxaprop-p-ethyl (0.054 kg/ha) + bentazon (0.84–1.08 kg/ha) + oil concentrate (2 L/ha)	EXCEL SUPER (80.5 g/L) + BASAGRAN (480 g/L) + ASSIST	0.67 L/ha (0.27 L/acre) + 1.75–2.25 L/ha (0.7–0.9 L/acre) + 2 L/ha (0.8 L/acre)	· Apply POST when beans are in the unifoliate to 4-trifoliate leaf stage and annual grasses are in the 2–5-leaf stage. · Apply POST to all dry common bean (*Phaseolus vulgaris*) market classes. · **Do NOT** use on adzuki beans. · Temporary crop injury may occur under abnormally hot, humid conditions. Reduce the oil concentrate to 1 L/ha (0.4 L/acre) when these conditions occur. Apply when weeds are small and actively growing. · Refer to the BASAGRAN label for information on specific weed stage and height. · If broadleaf and grass weeds are not in the correct leaf stage for a tank-mix application, use a split application at the correct stage for each product. · **Do NOT** apply if rain is expected within 6 hr after application.
fomesafen (0.24 kg/ha) + fluazifop-p-butyl (6 g/ha) + surfactant (0.5% v/v)	REFLEX (240 g/L) + VENTURE L (125 g/L) + TURBOCHARGE	1 L/ha (0.4 L/acre) + 0.6–2.0 L/ha (0.243–0.8 L/acre) + 5 L/1,000 L	· Apply POST to adzuki and all dry common bean (*Phaseolus vulgaris*) market classes when in the 1–2 trifoliate leaf stage. · **Do NOT** apply to adzuki or dry common beans past the third trifoliate leaf stage. · **Do NOT** use on lima beans. · Apply in 200 L/ha (80 L/acre) water. · The 0.6 L/ha (0.243 L/acre) rate is for the control of volunteer corn at the 2–5-leaf stage. · The 1 L/ha (0.4 L/acre) rate is for the control of annual grasses at the 2–4-leaf stage. · The 2 L/ha (0.8 L/acre) rate is for the control of quackgrass or wirestem muhly at the 3–5-leaf stage. · **Do NOT** harvest adzuki and dry beans within 84 days of application.

TABLE 7–2. Herbicide Treatment Rates for Beans (Adzuki, Dry, Lima and Snap) (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see *Notes on Herbicides*, page 40.
Preharvest			
carfentrazone-ethyl (0.0175–0.028 kg/ha) + non-ionic surfactant (0.25% v/v)	AIM EC (240 g/L) + non-ionic surfactant	73–117 mL/ha (30–47 mL/acre) + 2.5 L/1,000 L	· Apply to actively growing weeds, up to 10 cm. · Coverage of weed and crop foliage is essential for control. · **Do NOT** harvest within 1 day of application.
carfentrazone-ethyl (0.0175–0.028 kg/ha) + MERGE (0.1% v/v)	AIM EC (240 g/L) + MERGE	73–117 mL/ha (30–47 mL/acre) + 10 L/1,000 L	
saflufenacil (25–50 g/ha) + adjuvant (0.5% v/v)	ERAGON (70% SG) + MERGE	36–71 g/ha (14.5–29 g/acre) + 1 L/ha (0.4 L/acre)	· Apply when the stems are green to brown in colour and pods are mature (yellow-brown) and 80%–90% of the original leaves have dropped. · Apply in 200 L/ha (80 L/acre) of water. · **Do NOT** harvest within 3 days of application.
	ERAGON LQ (342 g/L) + MERGE	73–146 mL/ha (29.5–59 mL/ac) + 1 L/ha (0.4 L/acre)	
saflufenacil (25–50 g/ha) + glyphosate (900 g/ha) + adjuvant (0.5% v/v)	ERAGON (70% SG) + glyphosate (360 g/L)* + MERGE	36–71 g/ha (14.5–29 g/acre) + 2.5 L/ha (1 L/acre) + 1 L/ha (0.4 L/acre)	· Apply when the stems are green to brown in colour and pods are mature (yellow-brown) and 80%–90% of the original leaves have dropped. · Apply in 200 L/ha (80 L/acre) of water. · **Do NOT** harvest within 7 days of application. · Refer to preharvest precautions for glyphosate, page 110. * See Table 4–1. *Herbicides Used in Ontario*, page 30, for formulations available. See label for specific uses and rates.
	ERAGON LQ (342 g/L) + glyphosate (360 g/L)* + MERGE	73–146 mL/ha (29.5–59 mL/ac) + 2.5 L/ha (1 L/acre) + 1 L/ha (0.4 L/acre)	
glyphosate (0.9 kg/ha)	glyphosate (360 g/L)	2.5 L/ha (1 L/acre)	· Apply Preharvest when the crop is 30% grain moisture or less (yellow to brown pod colour, 80%–90% leaf drop) and at least 7 days prior to harvest. · **Do NOT** use on snap beans. · **Do NOT** apply to crops grown for seed. · **Do NOT** apply by air. · Apply in 50–100 L/ha of water. · **Do NOT** apply if rain is expected shortly after application. Refer to *Interval Before Rainfall (Postemergence)*, page 80 for more information on rainfast period of glyphosate products. * See Table 4–1. *Herbicides Used in Ontario*, page 30, for formulations available. See label for specific uses and rates.
	glyphosate (450 g/L)	2 L/ha (0.8 L/acre)	
	glyphosate (480 g/L)	1.86 L/ha (0.75 L/acre)	
	glyphosate (500 g/L)	1.8 L/ha (0.72 L/acre)	
	glyphosate (540 g/L)	1.67 L/ha (0.67 L/acre)	

TABLE 7–2. Herbicide Treatment Rates for Beans (Adzuki, Dry, Lima and Snap) (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see *Notes on Herbicides*, page 40.
Preharvest (cont'd)			
glufosinate ammonium (0.37–0.45 kg/ha)	IGNITE (150 g/L)	2.5–3 L/ha (1–1.2 L/acre)	· Apply Preharvest when approximately 50%–75% of the bean pods have naturally changed colour from green to yellow or brown and at least 9 days before harvest. · **Do NOT** use on snap beans. · **Do NOT** apply to dry beans grown for seed. · Use the higher rate when the crop canopy is dense and/or there are high populations of weeds present at application. · Apply in a minimum of 110 L/ha (44 L/acre) of water at a pressure of 275 kPa (40 psi). Where crop canopy is dense, or weed growth is heavy, apply 170–220 L/ha (68–88 L/acre) of water. · **Do NOT** apply by air. · **Do NOT** apply if rain is expected within 4 hours after application.
diquat (0.3–0.55 kg/ha) + surfactant (0.1% v/v)	REGLONE DESICCANT (240 g/L) + AGRAL 90	1.25–2.3 L/ha (0.5–0.92 L/acre) + 1 L/1,000 L	· Apply Preharvest when 80% natural leaf defoliation and 80% of the pods have turned yellow. · **Do NOT** use on lima or snap beans. · Avoid regrowth by targeting spray within 7 days of bean variety maturity date and harvest 5–7 days after application. · Use 1.25–1.7 L/ha (0.5 - 0.7 L/acre) by ground and 1.7–2.3 L/ha (0.7 - 0.92 L/acre) for aerial applications. · Use a minimum of 225 L/ha of spray volume. · Use the higher rate for heavy canopy of crop or weeds. · **Do NOT** apply if rain is expected within 15 minutes after application.
	REGLONE DESICCANT (240 g/L) + AG-SURF		
flumioxazin (53.7 g/ha) + methylated seed oil (2.5 L/ha)	VALTERA (51.1% DF) + MSO Concentrate	105 g/ha (42 g/acre) + 2.5 L/ha (1 L/acre)	· Apply in 140–280 L/ha (56–112 L/acre) of water. · **Do NOT** harvest within 5 days of application.
flumioxazin (53.7 g/ha) + glyphosate (900 g/ha) + methylated seed oil (2.5 L/ha)	VALTERA (51.1% DF) + glyphosate (360 g/L)* + MSO Concentrate	105 g/ha (42 g/acre) + 2.5 L/ha (1 L/acre) + 2.5 L/ha (1 L/acre)	· Apply in 140–280 L/ha (56–112 L/acre) of water. · **Do NOT** harvest within 7 days of application. · Refer to preharvest precautions for glyphosate, on this page.

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* See Table 4–1. *Herbicides Used in Ontario*, page 30, for formulations available. See label for specific uses and rates.

8. CEREAL CROPS

NOTES: Weed control ratings are given as 0–9 where 0 indicates no control and 9 indicates 90%–100% control under ideal conditions. Ratings are subjective values based on best available information and give general comparisons based on use as described in this guide. Under unfavourable conditions (e.g., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated. Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used. Always refer to the product label for more information on registered weed species, product uses and precautions.

TABLE 8–1. Herbicide Weed Control Ratings for Grassy Weeds in Cereal Crops

LEGEND: Numbers (0–9) = weed control ratings
✓ = can be used on this crop
Crop tolerance ratings: E = Excellent, G = Good, F = Fair, P = Poor
x = not indicated for use on this crop
– = insufficient information available to make a rating

	Crop Registrations										**Annual and Perennial Grasses**												
Trade Name	**oats**	**spring barley**	**spring wheat**	**winter barley**	**winter rye**	**winter wheat**	**alfalfa (underseeded)**	**red clover (underseeded)**	**trefoil (underseeded)**	**forage grasses (underseeded)**	**barnyard grass**	**bluegrass species**	**crabgrass**	**downy brome**	**fall panicum**	**foxtail, giant**	**foxtail, green**	**foxtail, yellow**	**witchgrass**	**proso millet**	**quackgrass**	**wild oats**	**Crop Tolerance**
Soil Applied Grass Herbicides																							
TREFLAN, RIVAL or BONANZA	x	x	x	x	✓	✓	x	x	x	x	9	–	9	–	9	9	9	9	9	7	2	8	F
Postemergence Grass Herbicides																							
ACHIEVE LIQUID or BISON	x	✓	✓	x	✓	✓	✓	✓	✓	x	8	–	–	–	–	–	9	9	–	–	0	9	G
AXIAL BIA	x	✓	✓	✓	x	✓	x	x	x	x	9	–	–	–	–	–	9	9	–	9	0	9	G
BENGAL or VIGIL	x	x	✓	x	x	x	x	x	x	x	9	–	–	–	–	–	9	9	–	–	0	9	G
PUMA ADVANCE	x	✓	✓	x	x	x	x	x	x	x	9	–	–	–	–	–	9	9	–	–	0	9	G

[1] Various formulations are available, see Table 4–1. Herbicides Used in Ontario, page 30.

TABLE 8–2. Herbicide Weed Control Ratings for Cereals

LEGEND: Numbers (0–9) = weed control ratings
✓ = can be used on this crop
Crop tolerance ratings: E = Excellent, G = Good, F = Fair, P = Poor
x = not indicated for use on this crop
– = insufficient information available to make a rating

	Crop Registrations										Annual Broadleaf Weeds																						Perennial Weeds										
Trade Name	**oats**	**spring barley**	**spring wheat**	**winter barley**	**winter rye**	**winter wheat**	**alfalfa (underseeded)**	**red clover (underseeded)**	**trefoil (underseeded)**	**forage grasses (underseeded)**	**atriplex, spreading**	**buckwheat, wild**	**canola, volunteer**	**cocklebur**	**chamomile, scentless**	**chickweed, common**	**cleavers**	**corn spurry**	**fleabane, Canada**	**hempnettle**	**lady's thumb**	**lamb's-quarters**	**lettuce, prickly**	**mustards**	**nightshades**	**pigweeds**	**ragweed, common**	**ragweed, giant**	**shepherd's purse**	**stinkweed**	**velvetleaf**	**violet, field**	**bindweed, field**	**carrot, wild**	**chickweed, mouse-eared**	**curled dock**	**dandelion**	**ground-ivy (creeping-charlie)**	**horsetail**	**sow-thistle**	**thistle, Canada**	**vetches**	**Crop Tolerance**
Soil Applied Broadleaf Herbicides																																											
ERAGON + glyphosate[1] + MERGE	x	✓	✓	✓	x	✓	x	x	x	x	–	9	9	9	–	–	–	–	9	–	9	9	9	9	9	9	9	7/8	9	9	9	8	–	–	–	–	8	–	7	8	9	–	E
TREFLAN **or** RIVAL **or** BONANZA	x	x	x	✓	✓	✓	x	x	x	x	–	5	0	2	–	–	–	–	0	5	2	8	–	2	2	8	2	1	–	–	2	–	2	–	–	0	0	–	2	2	2	–	F
Postemergence Broadleaf Herbicides																																											
2,4-D[1]	x	✓	✓	x	✓	✓	x	x	x	x	7	4	8	8	–	2	2	2	8	2	4	9	9	9	7	9	8	9	9	9	8	–	7	1	–	7	6	–	2	5	7	7	F
BANVEL II **or** ORACLE **or** HAWKEYE	✓	✓	✓	x	x	✓	x	x	x	✓	–	9	–	9	–	8	7	9	8	7	9	9	5	7	9	9	9	–	6	6	9	–	8	1	–	9	6	–	0	8	7	8	P
BUCTRIL M **or** BADGE **or** MEXTROL **or** LOGIC M	✓	✓	✓	x	✓	✓	x	✓	x	✓	6	9	9	8	5	2	4	2	6	7	9	9	8	9	9	8	9	7	9	9	9	5	7	1	–	–	4	–	7	7	5	5	E
DYVEL	✓	✓	✓	✓	x	✓	x	x	x	x	–	9	–	–	–	–	8	9	8	8	9	9	9	9	–	9	9	–	9	9	–	–	8	1	–	–	–	–	–	8	8	8	P
EMBUTOX **or** CALIBER **or** COBUTOX	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	–	6	7	9	–	2	–	2	–	2	4	9	–	7	7	9	8	–	8	6	8	–	–	–	2	6	5	–	2	5	–	2	G
ESTAPROP XT **or** DICHLORPROP-DX **or** TURBOPROP	x	✓	✓	x	x	✓	x	x	x	x	8	8	9	–	6	2	3	2	8	7	8	9	9	9	–	9	9	9	9	9	–	6	7	3	–	–	7	–	2	8	8	7	G
INFINITY	x	✓	✓	x	x	✓	x	x	x	x	7	9	9	–	6	9	8	–	9	9	9	9	8	9	9	9	9	7	9	9	9	5	–	2	–	–	7	–	–	8	7	5	E
LONTREL	x	✓	✓	x	x	x	x	x	x	x	3	8	0	5	8	2	–	–	9	–	5	2	–	2	2	2	7	–	–	–	–	–	–	–	–	–	4	–	–	9	9	9	F
MCPA[1]	✓	✓	✓	x	✓	✓	x	x	x	x	–	2	9	7	–	2	3	7	7	8	2	9	9	9	–	9	9	9	9	9	8	–	7	1	–	–	4	–	8	7	7	5	F
MCPA SODIUM	✓	✓	✓	x	✓	✓	x	✓	x	x	–	2	9	7	–	2	–	7	7	8	2	9	–	9	–	9	8	–	9	9	8	–	–	–	–	–	–	–	–	–	–	–	G
MECOPROP **or** COMPITOX	✓	✓	✓	✓	x	✓	x	x	x	x	–	2	–	–	–	9	–	9	–	2	2	9	–	9	–	9	9	–	–	7	–	–	–	–	9	–	–	–	–	–	7	5	G

[1] Various formulations are available, see Table 4–1. Herbicides Used in Ontario, page 30.

[2] Indicates product sold as a co-pack under this trade name.

[3] The rate of MCPA Ester included in REFINE M may not provide this level of control.

TABLE 8–2. Herbicide Weed Control Ratings for Cereals (cont'd)

LEGEND: Numbers (0–9) = weed control ratings
✓ = can be used on this crop

Crop tolerance ratings: E = Excellent, G = Good, F = Fair, P = Poor
x = not indicated for use on this crop

– = insufficient information available to make a rating

	Crop Registrations										Annual Broadleaf Weeds																						Perennial Weeds										
Trade Name	**oats**	**spring barley**	**spring wheat**	**winter barley**	**winter rye**	**winter wheat**	**alfalfa (underseeded)**	**red clover (underseeded)**	**trefoil (underseeded)**	**forage grasses (underseeded)**	**atriplex, spreading**	**buckwheat, wild**	**canola, volunteer**	**cocklebur**	**chamomile, scentless**	**chickweed, common**	**cleavers**	**corn spurry**	**fleabane, Canada**	**hempnettle**	**lady's thumb**	**lamb's-quarters**	**lettuce, prickly**	**mustards**	**nightshades**	**pigweeds**	**ragweed, common**	**ragweed, giant**	**shepherd's purse**	**stinkweed**	**velvetleaf**	**violet, field**	**bindweed, field**	**carrot, wild**	**chickweed, mouse-eared**	**curled dock**	**dandelion**	**ground-ivy (creeping-charlie)**	**horsetail**	**sow-thistle**	**thistle, Canada**	**vetches**	**Crop Tolerance**
Postemergence Broadleaf Herbicides (cont'd)																																											
PARDNER **or** BROMOTRIL **or** BROTEX **or** KORIL **or** BROMAX	✓	✓	✓	x	✓	✓	x	x	x	x	–	8	7	8	–	2	–	2	–	2	8	9	–	7	9	7	9	–	8	8	9	–	5	–	–	–	–	–	0	6	5	–	E
PIXXARO	x	x	x	x	x	✓	x	x	x	x	–	9	9	9	8	8	8	–	8	8	7	9	9	9	–	9	9	9	9	–	9	–	–	–	–	–	–	–	–	–	7	8	E
REFINE SG	✓	✓	✓	x	x	✓	x	x	x	x	–	9	9	–	7	9	6	9	4	9	9	9	8	8	–	9	2	–	9	9	8	7	2	8	–	–	5	–	–	8	7	5	E
TARGET **or** TRACKER XP **or** SWORD	✓	✓	✓	✓	x	✓	x	x	x	x	–	9	9	–	–	2	8	9	8	8	8	9	9	9	–	9	9	–	9	9	–	–	8	5	–	–	4	–	–	8	8	–	P
TROPHY[2]	x	x	x	x	x	✓	x	x	x	x	8	7	9	9	–	–	9	–	8	8	7	9	8	9	–	9	9	–	9	9	–	8	–	–	–	–	5	9	–	8	8	8	G
TROPOTOX PLUS **or** CLOVITOX PLUS **or** TOPSIDE	✓	✓	✓	✓	✓	✓	x	✓	x	✓	–	7	9	–	–	2	–	2	–	8	2	9	–	9	–	9	8	–	9	9	9	–	8	–	–	–	–	–	–	9	9	5	G
Postemergence Broadleaf Herbicide Tank-Mixes																																											
BUCTRIL M **or** BADGE **or** LOGIC M **or** MEXTROL + MCPA[1]	✓	✓	✓	x	✓	✓	x	x	x	x	6	9	9	8	7	2	4	2	6	7	9	9	9	9	9	9	9	9	9	9	9	5	7	1	–	7	6	–	7	7	8	–	F
(EMBUTOX **or** CALIBER **or** COBUTOX) + MCPA	✓	✓	✓	✓	x	✓	✓	x	✓	x	–	6	9	9	–	2	–	2	–	2	4	9	–	9	7	9	8	–	8	6	8	–	–	–	2	6	5	–	2	5	–	2	G
LONTREL + 2,4-D[1] **or** MCPA[1]	x	✓	✓	x	x	x	x	x	x	x	7	8	8	8	2	2	3	2	9	2	7	9	9	9	7	9	9	9	9	9	8	–	7	–	–	7	6	–	2	9	9	9	F
PARDNER **or** BROMOTRIL **or** BROTEX **or** KORIL **or** BROMAX + 2,4-D[1] **or** MCPA[1]	x	✓	✓	x	✓	✓	x	x	x	x	6	8	9	8	–	2	2	2	–	2	8	9	9	9	9	9	9	–	9	9	9	–	7	1	–	7	6	–	2	6	8	0	F
PEAK 75WG + PARDNER	x	x	x	x	x	✓	x	x	x	x	–	9	9	9	–	9	–	–	6	–	9	9	8	9	9	9	9	7	8	8	7	–	–	8	–	–	5	–	–	8	–	6	E
REFINE SG + 2,4-D[1]	x	✓	✓	x	x	✓	x	x	x	x	–	9	9	8	7	9	6	9	6	9	9	9	9	9	7	9	9	–	9	9	8	7	7	8	–	7	6	–	2	8	7	6	F
REFINE M[2,3]/BOOST M[2]	✓	✓	✓	x	x	✓	x	x	x	x	8[3]	9	9	8[3]	7	9	6	9	6[3]	9	9	9	9	9	7	9	9[3]	7[3]	9	9	8	7	7	8	–	7	6	–	2	8	7	6	G

[1] Various formulations are available, see Table 4–1. Herbicides Used in Ontario, page 30.

[2] Indicates product sold as a co-pack under this trade name.

[3] The rate of MCPA Ester included in REFINE M may not provide this level of control.

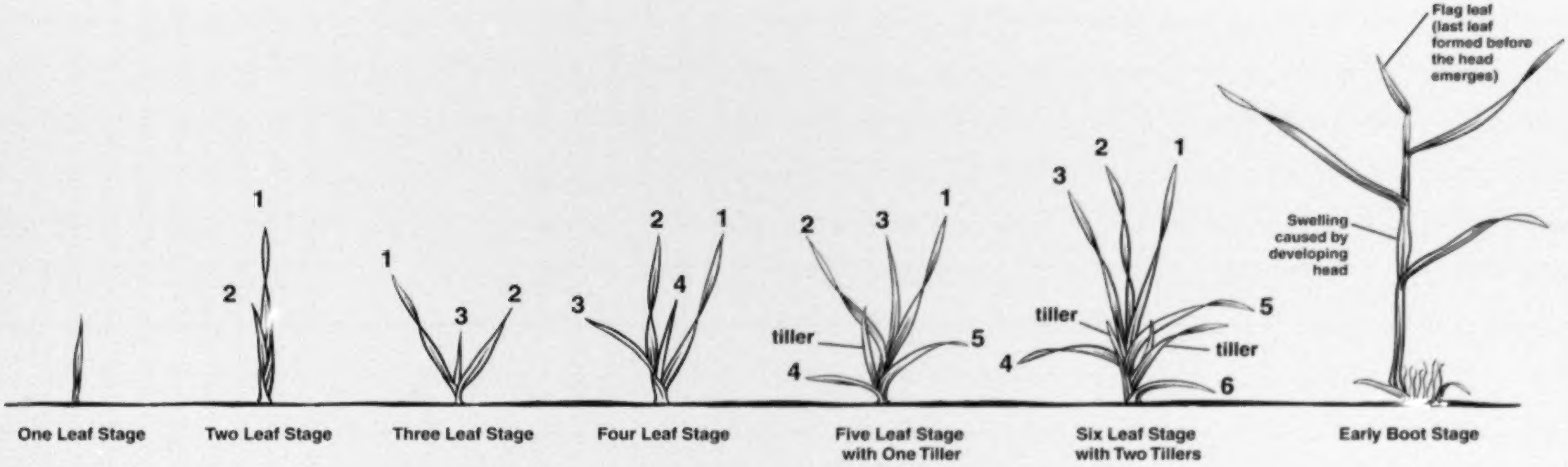
Flag leaf (last leaf formed before the head emerges)
Swelling caused by developing head
1
2
3
4
5
6
tiller
One Leaf Stage
Two Leaf Stage
Three Leaf Stage
Four Leaf Stage
Five Leaf Stage with One Tiller
Six Leaf Stage with Two Tillers
Early Boot Stage

FIGURE 8–1. Cereal Crop Growth Stages.

Cereals

Apply all treatments in 100–200 L/ha (40–80 L/acre) of water except where otherwise noted.

Crop rotation is a valuable technique used to prevent the build up of weed populations associated with small grain production. Wild oats can increase in population and severely limit production on fields where small grains are grown continuously. Some weeds (e.g., proso millet) will be well controlled by cereal competition.

Blind harrowing with a light harrow, before emergence of cereals, can help to control small germinating weeds. A light harrow can also be used in cereals up to the 3 leaf stage, or a weeder harrow (L shaped flexible tines) at the 4 leaf stage to provide better control of small annual broadleaf weeds. The timing of these harrowing operations is critical. The weeds must be small and the soil surface must be dry and easily worked.

Weeds must be emerged from the soil surface and in early stages of growth to be killed by the rates of the herbicides used on cereal grains. Weeds that are growing during early periods of cereal growth (up to 5 leaf stage) have the greatest effect on the cereal yield.

The growth stage for maximum safety varies with the cereal and the herbicide. Check the label for appropriate timing. When counting the leaves on cereal plants, some confusion can occur if tiller leaves are present. These leaves are not counted. Figure 8–1. *Cereal Crop Growth Stages,* on this page, is useful for identifying the cereal leaf stages that are mentioned in this chapter.

Cereal grains have an advantage in that they do not make use of the full growing season. This is particularly true of the winter cereals where preplant cultivation and postharvest cultivation can be used to stimulate germination of weed seeds and reduce perennial weed populations.

Herbicide Application Timings

- **Preplant** (PP) – Also see Chapter 6 *Preplant & Postharvest Weed Control,* page 91, for details of products, rates and remarks.
- **Preplant Incorporated** (PPI)
- **Preemergence** (PRE)

Postemergence (POST) – Leaf stage of the weeds is critical for good weed control. Smaller weeds are usually more sensitive to herbicides. Apply according to labelled leaf stages. Crop stage is important to optimize crop safety. Adjuvants will frequently improve the weed control when used as directed. Weather or other conditions may influence the optimum rate of adjuvant, see the product label for more details. Always use appropriate drift management technology.

TABLE 8–3. Herbicide Treatment Rates for Cereals

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Soil Applied Grass and Broadleaf Herbicides			
saflufenacil (25–50 g/ha) + glyphosate (900 g/ha) + adjuvant (0.5% v/v)	ERAGON (70% SG) + glyphosate (360 g/L)* + MERGE	36–71 g/ha (14.5–29 g/acre) + 2.5 L/ha (1 L/acre) + 1 L/ha (0.4 L/acre)	· Apply PP and PRE. · This treatment will provide suppression of secondary germination (flushes) of lamb's-quarters, red root pigweed, stinkweed, wild buckwheat and wild mustard. Use higher rate for longer residual activity.
	ERAGON LQ (342 g/L) + glyphosate (360 g/L)* + MERGE	73–146 mL/ha (29.5–59 mL/acre) + 2.5 L/ha (1 L/acre) + 1 L/ha (0.4 L/acre)	* Numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, page 30 for a complete list of available products.
trifluralin (0.383–0.546 kg/ha)	TREFLAN (480 g/L)	0.8–1.14 L/ha (0.32–0.46 L/acre)	· For use only on winter wheat and fall rye. · For loose silky bentgrass control in the fall. · Apply as soon as possible after planting. · Incorporate shallowly into the soil surface with drag harrows. · Seed the crop approximately 5 cm deep to separate the germinating seed from the chemical.
	RIVAL DF (60 DF)	0.64–0.91 kg/ha (0.26–0.36 kg/acre)	
	BONANZA 480 (480 g/L)	0.8–1.14 L/ha (0.38–0.55 L/acre)	
Postemergence Grass Herbicides			
tralkoxydim (0.2 kg/ha) + adjuvant (0.5% v/v)	ACHIEVE LIQUID (400 g/L) + TURBOCHARGE	0.5 L/ha (0.2 L/acre) + 5 L/1,000 L (5 L/1,000 L)	· **Do NOT** use on tame oats, winter barley and fall rye. · Apply at 1–6 leaf stage of wild oats. · Apply in 50–100 L/ha of water. · Herbicides not listed on the label may be applied separately 7 days after application of ACHIEVE LIQUID or BISON. · Wild oat control will be reduced if REFINE SG is applied before ACHIEVE LIQUID or BISON. · **Do NOT** tank-mix REFINE SG or REFINE M with ACHIEVE LIQUID or BISON. · **Do NOT** feed or graze underseeded forage in year of treatment. · Mature straw may be fed to livestock. One application per year.
	BISON (400 g/L) + ADDIT ADJUVANT		
Pinoxaden (60 g/ha)	AXIAL BIA (50 g/L)	1200 mL/ha (480 mL/acre)	· For use on barley, spring and winter wheat. · Apply from the 1 leaf to flag leaf stage of cereals when labelled weeds are in the 1–6 leaf stage of growth. · There are no crop rotation restrictions the year following AXIAL BIA application. · For fields treated with AXIAL BIA, no crop may be seeded until the following year. · When tank-mixing with a broadleaf herbicide, always add the broadleaf herbicide to the spray tank first; followed by AXIAL BIA. · AXIAL BIA can be tank-mixed with either REFINE SG at 30 g/ha (12 g/acre), INFINITY at 0.83 L/ha (0.33 L/acre) or BUCTRIL M at 1 L/ha (0.4 L/acre). · **Do NOT** add any adjuvants, chemical additives or fertilizers to mixtures with AXIAL BIA. · Observe a minimum interval to harvest of 60 days after treatment for grain and straw and of 30 days after treatment for hay. · Observe a minimum of 7 days before grazing livestock.

TABLE 8–3. Herbicide Treatment Rates for Cereals (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Postemergence Grass Herbicides (cont'd)			
fenoxaprop-p-ethyl/ safener (92.4 g/L)	BENGAL (120 g/L)	0.77 L/ha (0.31 L/acre)	· For use **ONLY** on spring wheat. · Use for control of wild oats and other grassy weeds. · Apply at the 1–6 leaf stage of spring wheat. · BENGAL and VIGIL contain a safener that enhances the cereal crops ability to metabolize fenoxaprop-p-ethyl. Other products containing fenoxaprop-p-ethyl and that do not contain this special safener (e.g., EXCEL SUPER) will cause unacceptable levels of crop injury.
	VIGIL (120 g/L)		
fenoxaprop-p-ethyl/ safener (91.8. g/ha)	PUMA ADVANCE (90 g/L)	1.02 L/ha (0.412 L/acre)	· For use **ONLY** on spring wheat and spring barley. · Use for control of wild oats and other grassy weeds. · Apply at the 1–6 leaf stage of spring wheat. · PUMA ADVANCE contains a safener that enhances the cereal crops ability to metabolize fenoxaprop-p-ethyl. Other products containing fenoxaprop-p-ethyl and that do not contain this special safener (e.g., EXCEL SUPER) will cause unacceptable levels of crop injury.
Postemergence Broadleaf Herbicides			
2,4-D (0.35–0.85 kg/ha)	2,4-D (470 g/L)*	0.75–1.8 L/ha (0.3–0.7 L/acre)	· **Do NOT** use on oats, winter barley and cereals underseeded with legumes. · Apply when spring cereals are in the 3–5 leaf stage of growth. **For Winter Cereals:** · **Do NOT** apply to seedling winter cereals in the fall. · For control of winter annuals apply early before flower buds appear on the weeds. * Numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, page 30 for a complete list of available products.
	2,4-D (564 g/L)*	0.62–1.4 L/ha (0.25–0.56 L/acre)	
	2,4-D (660 g/L)*	0.53–1.29 L/ha (0.21–0.52 L/acre)	
dicamba (0.11–0.139 kg/ha)	BANVEL II (480 g/L)	0.23–0.29 L/ha (0.09–0.12 L/acre)	· **Do NOT** use on winter barley, fall rye and cereals underseeded with legumes. · Control is best when weeds are in the 2–3 leaf stage or rosettes less than 5 cm diameter. Use the higher rates on older weeds. · **Do NOT** apply when night time air temperatures are below 10°C prior to and after application. · Apply to spring wheat and barley when they are in the 2–5 leaf stage. · Apply to winter wheat in the spring when the crop is 15–25 cm tall before the shot blade stage. · Underseeded seedling grasses should be at the 2–4 leaf stage.
	ORACLE (480 g/L)		
	HAWKEYE (480 g/L)		
bromoxynil/MCPA (0.56 kg/ha)	BUCTRIL M (560 g/L)	1 L/ha (0.4 L/acre)	· Apply when weeds are in the 2–6 leaf stage and cereals are in the 2 to early flag leaf stage. For control of winter annual weeds, apply before flower buds appear. · Best results are obtained with applications at the 2–5 leaf cereal stage since thorough spray coverage of weed foliage is required for optimum weed control. **Underseeded Red Clover (Winter Wheat Only):** · **Do NOT** use on fall rye or spring cereals underseeded with red clover. · Apply in the spring when the red clover is in the 1st–3rd trifoliate stage and when the winter wheat provides a protective canopy over the clover. · **Do NOT** apply in less than 200 L/ha water (80 L/acre). · **Do NOT** apply if clover is under stress, and avoid overlaps as injury may result.
	BADGE (450 g/L)	1.25 L/ha (0.5 L/acre)	
	MEXTROL (450 g/L)		
	LOGIC M (450 g/L)		

TABLE 8–3. Herbicide Treatment Rates for Cereals (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Postemergence Broadleaf Herbicides (cont'd)			
dicamba/MCPA (0.525 kg/ha)	DYVEL (420 g/L)	1.25 L/ha (0.5 L/acre)	· **Do NOT** use on fall rye, winter barley and cereals underseeded with legumes. · Apply when spring cereals are in the 2–5 leaf stage. · Hempnettle, corn spurry and cow cockle are controlled best when small. · Apply to winter wheat in the spring when weeds have emerged and the crop is 15–25 cm tall before the flag leaf stage. · **Do NOT** apply when night time air temperatures are below 10°C prior to and after application.
2,4-DB (1.1–1.4 kg/ha)	EMBUTOX (625 g/L) CALIBER 625 (625 g/L) COBUTOX 625 (625 g/L)	1.75–2.25 L/ha (0.7–0.9 L/acre)	· Apply 2,4-DB at the 5 leaf to early flag stage of cereals. · Oats may be damaged if treated before the 5 leaf stage. · Apply when the legumes are in the 1–4 trifoliate stage. · Use **ONLY** if cereals are underseeded to alfalfa, bird's foot trefoil, alsike, red or ladino clover and grasses. Red clover may be damaged by 2,4-DB. · Apply in 150–200 L/ha (60–80 L/acre) water. · Wild mustard plants are not controlled if sprayed when they are beyond the 4 leaf stage.
dichlorprop/2,4-D (740 g/ha)	ESTAPROP XT (610 g/L) DICHLORPROP DX (610 g/L)	1.2 L/ha (0.48 L/acre)	· **Do NOT** use on oats, winter barley and fall rye. · **Do NOT** use on spring barley or wheat underseeded with legumes. · Apply to emerged weeds at the 4 leaf to early flag leaf stage of spring cereals. **For Winter Wheat:** · Apply in early spring to emerged weeds. · May be used up to the early flag leaf stage. · **Do NOT** use if underseeded with legumes.
dichlorprop/2,4-D (1.017 kg/ha)	ESTAPROP PLUS (582 g/L) DICHLORPROP D (582 g/L) TURBOPROP (582 g/L)	1.75 L/ha (0.7 L/acre)	· **Do NOT** use on oats, winter barley and fall rye. · **Do NOT** use on spring barley or wheat underseeded with legumes. · Apply to emerged weeds at the 4 leaf to early flag leaf stage of spring cereals. **For Winter Wheat:** · Apply in early spring to emerged weeds. · May be used up to the early flag leaf stage. · **Do NOT** use if underseeded with legumes.
pyrasulfotole/bromoxynil (213 g/ha)	INFINITY	0.83 L/ha (0.33 L/acre)	· **Do NOT** use on oats, winter barley, fall rye or cereals underseeded with legumes. · Apply postemergence and prior to flag leaf emergence. · The addition of ammonium sulphate at 1 L/ha (0.4 L/acre) is required for the control of cleavers at the 4–6 whorl growth stage. · **Do NOT** graze the treated crops or cut for forage or hay within 25 days of application. · **Do NOT** harvest spring barley for grain or straw within 45 days of application. · **Do NOT** harvest wheat for grain or straw within 50 days of application.
clopyralid (0.15–0.2 kg/ha)	LONTREL 360 (360 g/L)	0.42–0.56 L/ha (0.17–0.22 L/acre)	· **Do NOT** use on oats, winter cereals or cereals underseeded with forage crops. · Apply when wheat or barley are at the 3 leaf to flag leaf emergence stages. · For the control of Canada thistle and perennial sow-thistle (top growth only).

TABLE 8–3. Herbicide Treatment Rates for Cereals (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Postemergence Broadleaf Herbicides (cont'd)			
MCPA (0.35–0.85 kg/ha)	MCPA (500 g/L)*	0.7–1.7 L/ha (0.28–0.68 L/acre)	· **Do NOT** use on cereals underseeded with forage crops. · Apply when the crop is in the 2–5 leaf stage of growth. · For hempnettle control, use the high rate of MCPA. * Numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, page 30 for a complete list of available products.
	MCPA (600 g/L)*	0.58–1.4 L/ha (0.23–0.56 L/acre)	
MCPA (0.3–0.45 kg/ha)	MCPA SODIUM 300 (300 g/L)*	1–1.5 L/ha (0.4–0.6 L/acre)	· For use on cereals underseeded to red clover. · Treat at an early stage of clover development when it is covered by a canopy of crop. · Apply in the spring when crop growth commences until early flag leaf stage. · Apply in 180–240 L/ha water (72–96 L/acre). · The lower rate may not kill ragweed. * Numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, page 30 for a complete list of available products.
mecoprop-P (0.83–1.05 kg/ha)	MECOPROP (150 g/L)	5.5–7 L/ha (2.2–2.8 L/acre)	· **Do NOT** use on fall rye and cereals underseeded with forage crops. · Use from the 3 leaf stage to early flag leaf when cereals are 10–15 cm tall. · Apply when weeds are in the 2–4 leaf stage. · Use the higher rate for more mature weeds.
	COMPITOX (150 g/L)		
bromoxynil (288 – 336 g/ha)	PARDNER (280 g/L)	1–1.2 L/ha (0.4 -0.48 L/acre)	· Apply when the weeds are in the 1–4 leaf stage and cereals are in the 2 to early flag leaf stage. Use the higher rate when weeds are past the 4 leaf stage. · **Spring Cereals:** Best results are in the 2–5 leaf cereal stage since thorough coverage of weed foliage is required for optimum weed control. · **Winter Wheat:** More effective on winter annuals when applied as a fall treatment.
	BROMOTRIL (240 g/L)	1.2–1.4 L/ha (0.48–0.56 L/acre)	
	BROTEX 240 (240 g/L)		
	KORIL (235 g/L)		
	BROMAX (480 g/L)	0.6 – 0.7 L/ha (0.24 – 0.28 L/acre)	
	BROTEX 480 (480 g/L)		
halauxifen/fluroxypyr (82 g/ha) + MCPA (372 g/ha)	PIXXARO (sold as co-pack) PIXXARO A (16.25/250 g/L) + MCPA Ester 600 (600 g/L)	308 mL/ha (124 mL/acre) 620 mL/ha (250 mL/acre)	· Apply to actively growing winter wheat from the 3 leaf stage to just prior to flag leaf emergence. · Extreme growing conditions such as drought or near freezing temperature prior to at or following application may reduce weed control and increase the risk of crop injury at all stages of growth. · If foliage is wet at the time of application control may be decreased. · Only weeds which are emerged at the time of application will be affected.
thifensulfuron–methyl/ tribenuron–methyl (15 g/ha) + non ionic surfactant (0.2% v/v)	REFINE SG (50%) + non ionic surfactant	30 g/ha (12 g/acre) + 2 L/1,000 L	· **Do NOT** use on winter barley, fall rye and cereals underseeded with forage crops. · Apply when the cereal crop is in the 2 leaf to flag leaf stage. · **Winter Wheat:** Apply once either in the fall or spring. · Apply to young actively growing weeds that are less than 10 cm tall or across. · Canada thistle, sow-thistle and round-leaved mallow are suppressed.

TABLE 8–3. Herbicide Treatment Rates for Cereals (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Postemergence Broadleaf Herbicides (cont'd)			
dicamba/MCPA/ mecoprop (0.4–0.6 kg/ha)	TARGET (400 g/L) TRACKER XP (400 g/L) SWORD (400 g/L)	1–1.5 L/ha (0.4–0.6 L/acre)	· **Do NOT** use on rye and cereals underseeded with forage crops. · Use when spring wheat or oats are in the 2–5 leaf stage or spring barley in the 2–4 leaf stage. · **Winter Cereals:** Apply in spring before the crop is more than 30 cm high (top leaf extended). · Apply when weeds are in the 2–3 leaf stage. · Use the high rate if weeds are beyond the 3 leaf stage. · **Do NOT** apply when night time air temperatures are below 10°C prior to and after application.
fluroxypyr (108 g/ha) + MCPA (560 g/ha)	TROPHY (sold as a co-pack): TROPHY A (180 g/L) + TROPHY B (500 g/L)	0.6 L/ha (0.24 L/acre) + 1.12 L/ha (0.45 L/acre)	· For use only on winter wheat. · Apply from the 3-tiller until the early flag leaf stage of winter wheat. · **Do NOT** apply to winter wheat underseeded to red clover. · **Do NOT** apply within 60 days of harvest and only once per year.
MCPB/MCPA (1.1–1.7 kg/ha)	TROPOTOX PLUS (400 g/L) CLOVITOX PLUS (400 g/L) TOPSIDE (400 g/L)	2.75–4.25 L/ha (1.1–1.7 L/acre)	· Apply MCPB/MCPA from the 2 leaf stage to flag leaf stage of spring cereals. · **Winter Cereals:** Apply in the spring when the crop is in the 2 leaf to flag leaf stage. · Use **ONLY** if cereals are underseeded to red, alsike, ladino or white Dutch clover and grasses. · Apply when legumes are in the unifoliate to the 4th trifoliate leaf stage. · Apply in 150–200 L/ha (60–80 L/acre) water.
Postemergence Tank-Mixes			
tralkoxydim (0.2 kg/ha) + bromoxynil/MCPA (0.56 kg/ha) + adjuvant (0.5% v/v)	ACHIEVE LIQUID (400 g/L) + BUCTRIL M (560 g/L) + adjuvant	0.5 L/ha (0.2 L/acre) + 1 L/ha (0.4 L/acre) + 5 L/1,000 L	· **Do NOT** use on oats, winter barley or fall rye. · Apply when the wild oats are in the 1–6 leaf stage, broadleaf weeds in the 1–4 leaf stage and when the cereals are in the 2 to early flag leaf stage. · Refer also to precautions for ACHIEVE LIQUID and BISON, page 117 and BUCTRIL M, BADGE, MEXTROL and LOGIC M on page 118. · The TURBOCHARGE adjuvant must be used with ACHIEVE LIQUID and ADDIT ADJUVANT is sold with BISON.
	BISON (400 g/L) + BUCTRIL M (560 g/L) + adjuvant		
	ACHIEVE LIQUID (400 g/L) + bromoxynil/MCPA (450 g/L)* + adjuvant	0.5 L/ha (0.2 L/acre) + 1.25 L/ha (0.5 L/acre) + 5 L/1,000 L	* Numerous products exist, refer to Table 4–1. Herbicides Used in Ontario,page 30 for a complete list of available products.
	BISON (400 g/L) + bromoxynil/MCPA (450 g/L)* + adjuvant		

TABLE 8–3. Herbicide Treatment Rates for Cereals (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Postemergence Tank-Mixes (cont'd)			
tralkoxydim (0.2 kg/ha) + bromoxynil (0.28–0.336 kg/ha) + adjuvant (0.5% v/v)	ACHIEVE LIQUID (400 g/L) + PARDNER (280 g/L) + adjuvant	0.5 L/ha (0.2 L/acre) + 1–1.12 L/ha (0.4–0.48 L/acre) + 5 L/1,000 L	· **Do NOT** use on oats, winter barley or fall rye. · Apply when the wild oats are in the 1–6 leaf stage, broadleaf weeds in the 1–4 leaf stage and when the cereals are in the 2 leaf to early flag leaf stage. · Refer also to precautions for ACHIEVE LIQUID and BISON, page 117 and PARDNER, BROMOTRIL, BROTEX and KORIL on page 120. · The TURBOCHARGE adjuvant must be used with ACHIEVE LIQUID and ADDIT ADJUVANT is sold with BISON.
	BISON (400 g/L) + PARDNER (280 g/L) + adjuvant		
	ACHIEVE LIQUID (400 g/L) + bromoxynil (240 g/L) + adjuvant	0.5 L/ha (0.2 L/acre) + 1.2–1.4 L/ha (0.48–0.56 L/acre) + 5 L/1,000 L	* Numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, page 30 for a complete list of available products.
	BISON (400 g/L) + bromoxynil (240 g/L) + adjuvant		
fenoxaprop-p-ethyl/ SAFENER (92.4 g/L) + bromoxynil/MCPA (0.56 kg/ha)	BENGAL (120 g/L) + BUCTRIL M (560 g/L)	0.77 L/ha (0.31 L/acre) + 1 L/ha (0.4 L/acre)	· For use **ONLY** on spring wheat. · Use for control of wild oats, grassy and broadleaf weeds. · Apply at the 1–6 leaf stage of spring wheat. · BENGAL and VIGIL contain a safener that enhances the cereal crops ability to metabolize fenoxaprop-p-ethyl. Other products containing fenoxaprop-p-ethyl and that do not contain this special safener (e.g., EXCEL SUPER) will cause unacceptable levels of crop injury.
	VIGIL (120 g/L) + BUCTRIL M (560 g/L)		
	BENGAL (120 g/L) + bromoxynil (450 g/L)	0.77 L/ha (0.31 L/acre) + 1.25 L/ha (0.5 L/acre)	
	VIGIL (120 g/L) + bromoxynil (450 g/L)		* Numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, page 30 for a complete list of available products.
bromoxynil/MCPA (0.56 kg/ha) + MCPA (0.28 kg/ha)	BUCTRIL M (560 g/L) + MCPA AMINE (500 g/L)	1 L/ha (0.4 L/acre) + 0.55 L/ha (0.22 L/acre)	· **Do NOT** use on cereals underseeded with forage crops (including red clover). · Add MCPA for improved control of hempnettle (up to the 4 leaf stage) and volunteer canola (up to the 8 leaf stage). · Add MCPA to the spray tank first, followed by either BUCTRIL M, MEXTROL, BADGE or LOGIC M.
	BADGE (450 g/L) + MCPA AMINE (500 g/L)	1.25 L/ha (0.5 L/acre) + 0.55 L/ha (0.22 L/acre)	
	MEXTROL (450 g/L) + MCPA AMINE (500 g/L)		
	LOGIC M (450 g/L) + MCPA AMINE (500 g/L)		

TABLE 8–3. Herbicide Treatment Rates for Cereals (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Postemergence Tank-Mixes (cont'd)			
2,4-DB (0.8 kg/ha) + MCPA (35 g/ha)	EMBUTOX (625 g/L) + MCPA AMINE (500 g/L)	1.25 L/ha (0.5 L/acre) + 70 mL/ha (28 mL/acre)	· Apply when the legumes are in the 1–4 leaf stage. · Use if cereals are underseeded only to alfalfa, bird's foot trefoil, alsike or ladino clover and grasses. · The addition of MCPA gives better control of common mustard than 2,4-DB alone. · Apply in 150–200 L/ha (60–80 L/acre) water.
	CALIBER 625 (625 g/L) + MCPA AMINE (500 g/L)		
	COBUTOX 625 (625 g/L) + MCPA AMINE (500 g/L)		
pyrasulfotole/ bromoxynil (213 g/ha) + tralkoxydim (0.2 kg/ha) + adjuvant (0.5% v/v)	INFINITY + ACHIEVE LIQUID (400 g/L) + adjuvant	0.83 L/ha (0.33 L/acre) + 0.5 L/ha (0.2 L/acre) + 5 L/1,000 L	· **Do NOT** use on oats, winter barley, fall rye or cereals underseeded with legumes. · Apply postemergence and prior to flag leaf emergence. · The addition of ammonium sulphate at 1 L/ha (0.4 L/acre) is required for the control of cleavers at the 4–6 whorl growth stage. · **Do NOT** graze the treated crops or cut for forage or hay within 25 days of application. · **Do NOT** harvest wheat or spring barley for grain or straw within 45 days of application. · The TURBOCHARGE adjuvant must be used with ACHIEVE LIQUID and ADDIT ADJUVANT is sold with BISON.
	INFINITY + BISON (400 g/L) + adjuvant		
clopyralid (0.1–0.25 kg/ha) + 2,4-D (0.35–0.85 kg/ha)	LONTREL 360 (360 g/L) + 2,4-D (470 g/L)*	0.28–0.69 L/ha (0.11–0.28 L/acre) + 0.75–1.81 L/ha (0.3–0.72 L/acre)	· For use **ONLY** on spring barley and spring wheat. · LONTREL is not registered for use on oats in Eastern Canada. · **Do NOT** use products containing 2,4-D on oats due to the probability of crop injury. · In combination with 2,4-D or MCPA, the lower rate of LONTREL 360 will provide control of Canada thistle for 6–8 weeks and the higher rate of LONTREL 360 will provide season long control of Canada thistle. * Numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, page 30 for a complete list of available products.
clopyralid (0.1–0.25 kg/ha) + MCPA (0.35–0.85 kg/ha)	LONTREL 360 (360 g/L) + MCPA AMINE (500 g/L)*	0.28–0.69 L/ha (0.11–0.28 L/acre) + 0.7–1.7 L/ha (0.28–0.68 L/acre)	
bromoxynil (0.28 kg/ha) + 2,4-D (0.28 kg/ha)	PARDNER (280 g/L) + 2,4-D (470 g/L)*	1–1.2 L/ha (0.4–0.48 L/acre) + 0.6 L/ha (0.24 L/acre)	· **Do NOT** use on winter barley and fall rye. · **Do NOT** use on cereals underseeded with forage crops. · **Do NOT** use the 2,4-D tank mix on oats. · Apply to cereals in the spring from the 4 leaf to early flag leaf stage. · Include 2,4-D or the lower rate of MCPA if mustards are present. · Use the higher rate of MCPA if hempnettle is present. * Numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, page 30 for a complete list of available products.
	bromoxynil (240 g/L) + 2,4-D (470 g/L)*	1.2–1.4 L/ha (0.48–0.56 L/acre) + 0.6 L/ha (0.24 L/acre)	
	bromoxynil (480 g/L)* + 2,4-D (470 g/L)*	0.6 – 0.7 L/ha (0.24 – 0.28 L/acre) + 0.6 L/ha (0.24 L/acre)	
bromoxynil (0.28 kg/ha) + MCPA (0.28–0.55 kg/ha)	PARDNER (280 g/L) + MCPA AMINE (500 g/L)*	1–1.2 L/ha (0.4–0.48 L/acre) + 0.55–1.1 L/ha (0.22–0.44 L/acre)	
	bromoxynil (240 g/L) + MCPA AMINE (500 g/L)*	1.2–1.4 L/ha (0.48–0.56 L/acre) + 0.55–1.1 L/ha (0.22–0.44 L/acre)	
	bromoxynil (480 g/L)* + MCPA AMINE (500 g/L)*	0.6 – 0.7 L/ha (0.24 – 0.28 L/acre) + 0.55–1.1 L/ha (0.22–0.44 L/acre)	

TABLE 8–3. Herbicide Treatment Rates for Cereals (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Postemergence Tank-Mixes (cont'd)			
prosulfuron (10 g/ha) + bromoxynil (140 g/ha) + non-ionic surfactant (0.2% v/v)	PEAK 75 WG + PARDNER (280 g/L) + non-ionic surfactant	13.3 g/ha (5.3 g/acre) + 0.5 L/ha (0.2 L/acre) + 2 L/1,000 L	• For use **ONLY** on winter wheat. • Apply POST up until stem elongation of winter wheat. • **Do NOT** apply to winter wheat underseeded to red clover or other legumes.
fenoxaprop-p-ethyl/ safener (91.8 g/ha) + bromoxynil/MCPA (0.56 kg/ha)	PUMA ADVANCE (90 g/L) + BUCTRIL M (560 g/L)	1.02 L/ha (0.412 L/acre) + 1 L/ha (0.4 L/acre)	• For use **ONLY** on spring wheat. • Refer to precautions for PUMA ADVANCE, page 118 and BUCTRIL M, page 118.
fenoxaprop-p-ethyl/ safener (91.8 g/ha) + pyrasulfotole/ bromoxynil (213 g/ha)	PUMA ADVANCE (90 g/L) + INFINITY	1.02 L/ha (0.412 L/acre) + 0.83 L/ha (0.33 L/acre)	• Refer to precautions for PUMA ADVANCE, page 118 and INFINTY, page 119. • For use **ONLY** on spring wheat.
fenoxaprop-p-ethyl/ safener (91.8 g/ha) + MCPA (420 g/ha)	PUMA ADVANCE (90 g/L) + MCPA 500	1.02 L/ha (0.412 L/acre) + 0.84 L/ha (0.336 L/acre)	• Refer to precautions for PUMA ADVANCE, page 118 and MCPA, page 120. • For use **ONLY** on spring wheat.
fenoxaprop-p-ethyl/ safener (91.8 g/ha) + thifensulfuron-methyl/ tribenuron-methyl (15 g/ha) + MCPA* (420 g/ha)	PUMA ADVANCE (90 g/L) + REFINE M (sold as a co-pack): [REFINE SG (50%) + MCPA (500 g/L)*]	1.02 L/ha (0.412 L/acre) + [30 g/ha (12 g/acre) + 0.84 L/ha (0.336 L/acre)]	• Refer to precautions for PUMA ADVANCE, page 118 and REFINE M, below. • For use **ONLY** on spring wheat. • **NOTE:** If using PUMA 120 SUPER, apply at a rate of 770 mL/ha (312 mL/acre). * Numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, page 30 for a complete list of available products.
thifensulfuron-methyl/ tribenuron-methyl (15 g/ha) + 2,4-D* (0.42–0.55 kg/ha) + non ionic surfactant (0.2% v/v)	REFINE SG (50%) + 2,4-D (470 g/L)* + non ionic surfactant	30 g/ha (12 g/acre) + 0.84–1.1 L/ha (0.34–0.45 L/acre) + 2 L/1,000 L	• **Do NOT** use on winter barley, fall rye and cereals underseeded with forage crops. • **Do NOT** apply 2,4-D tank-mix on oats. • Apply tank-mixes from the full 3 leaf stage to the early flag leaf stage of the crop. * Numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, page 30 for a complete list of available products.
	REFINE SG (50%) + 2,4-D (564 g/L)* + non ionic surfactant	30 g/ha (12 g/acre) + 0.7–0.9 L/ha (0.28–0.36 L/acre) + 2 L/1,000 L	
	REFINE SG (50%) + 2,4-D (660 g/L)* + non ionic surfactant	30 g/ha (12 g/acre) + 0.6–0.8 L/ha (0.24–0.32 L/acre) + 2 L/1,000 L	

TABLE 8–3. Herbicide Treatment Rates for Cereals (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Postemergence Tank-Mixes (cont'd)			
thifensulfuron-methyl/ tribenuron-methyl (15 g/ha) + MCPA* (285 g/ha) + non ionic surfactant (0.2% v/v)	REFINE M (sold as a co-pack): REFINE SG (50%) + MCPA ESTER (600 g/L)* + non ionic surfactant	30 g/ha (12 g/acre) + 475 mL/ha (190 mL/acre) + 2 L/1,000 L (2 L/1,000 L)	· **Do NOT** use on winter barley, fall rye and cereals underseeded with forage crops. · Apply tank-mixes from the full 3 leaf stage to the early flag leaf stage of the crop. * Numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, page 30 for a complete list of available products.
	BOOST M (sold as co-pack) BOOST (75%) + MCPA ESTER (600 g/L)* + non ionic surfactant	20 g/ha (8 g/acre) + 925 mL/ha (375 mL/acre) + 2 L/1,000 L	
Preharvest			
carfentrazone-ethyl (17.5–28 g/ha) + non-ionic surfactant (0.25% v/v)	AIM EC (240 g/L) + non-ionic surfactant	73–117 mL/ha (30–47 mL/acre) + 2.5 L/1,000 L (2.5 L/1,000 L)	· Apply to actively growing weeds, up to 10 cm. · Coverage of weed and crop foliage is essential for control. · **Do NOT** harvest within 3 days of application.
carfentrazone-ethyl (17.5–28 g/ha) + MERGE (0.1% v/v)	AIM EC (240 g/L) + MERGE	73–117 mL/ha (30–47 mL/acre) + 10 L/1,000 L	
Saflufenacil (25.2 – 49.7 g/ha) + adjuvant (1 L/ha)	ERAGON LQ (342 g/L) + MERGE	73–146 mL/ha (29.5 - 59 mL/ac) +1 L/ha (0.4 L/ac)	· Apply at hard dough stage when crop is at 30% grain moisture or less · Apply in 200 L/ha (80 L/ac) of water. · Preharvest interval (PHI) is 3 days. · For use only on wheat (durum, spring, winter), barley (spring, winter, malting), and triticale
Saflufenacil (25.2 – 49.7 g/ha) + glyphosate (900 g/ha) + adjuvant (1 L/ha)	ERAGON LQ (342 g/L) +GLYPHOSATE (360 g/L)* + MERGE	73–146 mL/ha (29.5 - 59 mL/ac) + 2.5 L/ha (1 L/ac) +1 L/ha (0.4 L/ac)	· Apply at hard dough stage when crop is at 30% grain moisture or less · Apply in 200 L/ha (80 L/ac) of water. · **Do NOT** apply to crops grown for seed. · Refer to preharvest precautions for glyphosate, page 125. · For use only on wheat (durum, spring, winter), barley (spring, winter, malting), and triticale
glyphosate (0.9 kg/ha)	glyphosate (360 g/L)*	2.5 L/ha (1 L/acre)	· Apply in 50–100 L/ha (20–40 L/acre) water when crop is at 30% grain moisture or less. · Apply at least 7 days prior to harvest and use ground application only. · **Do NOT** apply to seed crops. * Numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, page 30 for a complete list of available products.
	other glyphosate products	See Table 4–2.	

COVER CROPS: Cover crops can suppress weed growth and reduce the amount of weed seeds returned to the soil. Typically, cover crops that are planted after cereal harvest provided the most benefit in reducing the amount of weed seeds produced and returned to the soil. A comparison of cover crops and their ability suppress weed growth can be found in Table 8–4.

TABLE 8–4. Relative ranking of cover crops and their ability to suppress weeds. Adapted from the Midwest Cover Crops Council Cover Crop Decision Tool.

Rye, Winter cereal	Excellent
Triticale, Winter	Excellent
Buckwheat*	Excellent
Mustard, Oriental*	Excellent
Radish, Oilseed*	Excellent
Barley (spring or winter)	Very Good
Oats	Very Good
Triticale, Spring	Very Good
Red clover	Very Good
Ryegrass, Annual	Good
Peas, Field	Good

Source: mccc.dev.amr.msu.edu

* Do not allow these cover crops to go to seed otherwise they will produce weedy volunteers in the next season.

9. CORN (FIELD, SEED & SWEET)

NOTES: Weed control ratings are given as 0–9 where 0 indicates no control, and 9 indicates 90%–100% control under ideal conditions. Ratings are subjective values based on best available information and given general comparisons based on use as described in this guide. Under unfavourable conditions (e.g., too dry, too wet, too cold or poor application) the herbicides may not be as effective as indicated. Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used. Always refer to the product label for more information on registered weed species, product uses and precautions.

TABLE 9–1. Conventional Corn (Field, Seed and Sweet) Herbicide Weed Control Ratings

LEGEND: Numbers (0–9) = weed control ratings
✓ = can be used on this crop
R = populations resistant to this herbicide exist in Ontario and won't be adequately controlled if present
Crop tolerance ratings: E = Excellent, G = Good, F = Fair, P = Poor
x = not indicated for use on this crop
– = insufficient information available to make a rating
* = sold as a co-pack under this trade name

	Crop			**Annual Grasses**									**Annual Broadleaves**												**Perennials**							
Trade Name	**seed corn**	**sweet corn**	**field corn**	**barnyard grass**	**smooth crabgrass**	**large crabgrass**	**fall panicum**	**foxtail, giant**	**foxtail, green**	**foxtail, yellow**	**witchgrass**	**proso millet**	**buckwheat, wild**	**cocklebur**	**corn spurry**	**fleabane, Canada**	**lady's thumb**	**lamb's-quarters**	**mustards**	**nightshades**	**pigweeds**	**ragweed, common**	**ragweed, giant**	**velvetleaf**	**bindweed, field**	**horsetail**	**milkweed**	**nutsedge**	**quackgrass**	**sow-thistle**	**thistle, Canada**	**Crop Tolerance**
Preplant Burndown Herbicides – Refer to Tables 6–1. *Non-Selective Herbicides Available for Preplant Site Preparation*, page 91 and 6–2. *Preplant Herbicide Weed Control Ratings*, page 93 for a list of herbicides and weed control ratings.																																
Soil Applied Grass and Broadleaf Herbicides (Preemergence Timing Only)																																
FOCUS*	x	x	✓	9	9	8	–	9	9	9	–	–	8	–	–	–	–	8	9	9	7	–	–	6	–	–	–	–	–	–	–	E
INTEGRITY	x	✓	✓	9	9	9	8	8	9	9	9	4	9	8	–	9	8	8	9	9[1]	9	8	5	9	6	5	0	8[1]	0	0	0	E
PRINCEP NINE-T **or** SIMADEX **or** SIMAZINE 480	✓	✓	✓	9	9	9	8[2]	8	8	8	9	4	9	8	7[1]	–	9	9	9	9	9	9	8[4]	9	2	0	0	8[1,2]	0	0	0	E
Soil Applied Tank-Mixes (Preemergence Timing Only)																																
DUAL II MAGNUM + LOROX + AATREX	x	✓	x	9	9	9	8	8	9	9	9	2	9	5	9	–	9	9	9	9	9	9	–	7	0	0	0	7	0	0	0	E
PRIMEXTRA II MAGNUM + LOROX	x	x	✓	9	9	9	8	8	9	9	9	2	9	5	9	–	9	9	9	9	9	9	–	7	0	0	0	7	0	0	0	E

[1] PPI timing is needed to achieve this level of control.
[2] Use the high rate of herbicide for optimum control.
[3] Use PRE timing for optimum control.
[4] Weed must be emerged to achieve this level of control.
[5] For use on all sweet corn varieties, however not all varieties have been tested. Contact the variety manufacturer for more information on the tolerance of a specific variety.
[6] Various formulations available, see Table 4–1. *Herbicides Used in Ontario*, page 30. See label for specific uses and rates.
[7] The addition of atrazine is required to achieve this level of control.

TABLE 9–1. Conventional Corn (Field, Seed and Sweet) Herbicide Weed Control Ratings (cont'd)

LEGEND: Numbers (0–9) = weed control ratings | Crop tolerance ratings: E = Excellent, G = Good, F = Fair, P = Poor | – = insufficient information available to make a rating
✓ = can be used on this crop | x = not indicated for use on this crop | * = sold as a co-pack under this trade name
R = populations resistant to this herbicide exist in Ontario and won't be adequately controlled if present

	Crop			Annual Grasses									Annual Broadleaves												Perennials							
Trade Name	seed corn	sweet corn	field corn	barnyard grass	smooth crabgrass	large crabgrass	fall panicum	foxtail, giant	foxtail, green	foxtail, yellow	witchgrass	proso millet	buckwheat, wild	cocklebur	corn spurry	fleabane, Canada	lady's thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed, common	ragweed, giant	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada	Crop Tolerance
Soil Applied Broadleaf Herbicides (Preemergence timing only)																																
AATREX	✓	✓	✓	2	2	2	2	2	2	2	2	2	9	5	9	5	9	9^{R}	9	9	9^{R}	9^{R}	6	5	2	0	0	0	2	2	0	E
BANVEL II **or** ORACLE **or** HAWKEYE	x	x	✓	0	0	0	0	0	0	0	0	0	8	6	8	8	9	9	6	9	9	9	7	8	2	0	0	0	0	2	2	G
BROADSTRIKE RC	x	x	✓	0	0	0	0	0	5	0	0	0	–	7	–	7^{R}	8	9^{R}	8	7^{R}	9^{R}	8^{R}	7^{R}	9	–	8	–	–	–	–	–	G
CALLISTO + AATREX	✓	✓	✓	2	0	4	0	2	2	2	2	2	8	7	–	8	9	9	9	9	9	8	8	9	2	0	0	0	0	0	0	E
MARKSMAN	x	x	✓	2	2	2	2	2	2	2	2	2	9	6	9	9	9	9	9	9	9	9	7	8	2	0	0	0	2	2	2	G
Soil Applied and Early Postemergence Grass Herbicides																																
DUAL II MAGNUM	✓	✓	✓	9	9	9	8[2]	8	9	9	9	4	2	2	2	–	2	7	2	9[2,3]	8[2]	4	3	3	0	0	0	8[1,2]	0	0	0	E
FRONTIER MAX	✓	✓	✓	9	9	9	8[2]	8	9	9	9	4	2	2	2	–	2	7	2	9[2,3]	8[2]	4	3	3	0	0	0	8[1,2]	0	0	0	E
PROWL H20	x	x	✓	9	9	9	9	8	8	8	–	5	–	–	–	–	6	9	0	8	8	2	–	6	–	–	–	–	–	–	–	E
Soil Applied and Early Postemergence Grass and Broadleaf Herbicides																																
BATTALION*	x	x	✓	9	8	8	9	8	8	8	9	9[4]	9	–	8	8	8	9	8	8	9	9	7	8	–	–	–	–	7[4]	7[4]	–	G
CONVERGE XT*	✓	x	✓	9	9	9	9[2]	9	9	9	9	8[2]	8	7	–	6	9	9	9	9	9	9	7	9	–	0	0	0	0	0	0	E
ENGARDE*	x	x	✓	9	8	8	9	9	9	7	9	9	9	5	8	–	9	9	9	9	9	8	–	9	–	–	–	8[4]	7[4]	–	–	E
FOCUS*	x	x	✓	9	9	8	–	9	9	9	–	–	8	–	–	–	–	8	9	9	9	7	–	6	–	–	–	8[4]	7[4]	–	–	E
LUMAX EZ	✓	✓	✓	9	9	9	8[2]	8	8	8	9	4	8	8	–	8	9	9	9	9	9	8	8[4]	9	–	–	–	–	–	–	–	E
PRIMEXTRA II MAGNUM	✓	✓	✓	9	9	9	8	8	9	9	9	2	9	5	9	6	9	9^{R}	9	9	9	9^{R}	–	2	0	0	0	8[1,2]	0	0	0	E

[1] PPI timing is needed to achieve this level of control.
[2] Use the high rate of herbicide for optimum control.
[3] Use PRE timing for optimum control.
[4] Weed must be emerged to achieve this level of control.
[5] For use on all sweet corn varieties, however not all varieties have been tested. Contact the variety manufacturer for more information on the tolerance of a specific variety.
[6] Various formulations available, see Table 4–1. *Herbicides Used in Ontario*, page 30. See label for specific uses and rates.
[7] The addition of atrazine is required to achieve this level of control.

TABLE 9–1. Conventional Corn (Field, Seed and Sweet) Herbicide Weed Control Ratings (cont'd)

LEGEND: Numbers (0–9) = weed control ratings
✓ = can be used on this crop
R = populations resistant to this herbicide exist in Ontario and won't be adequately controlled if present
Crop tolerance ratings: E = Excellent, G = Good, F = Fair, P = Poor
x = not indicated for use on this crop
– = insufficient information available to make a rating
* = sold as a co-pack under this trade name

	Crop			Annual Grasses									Annual Broadleaves												Perennials							
Trade Name	seed corn	sweet corn	field corn	barnyard grass	smooth crabgrass	large crabgrass	fall panicum	foxtail, giant	foxtail, green	foxtail, yellow	witchgrass	proso millet	buckwheat, wild	cocklebur	corn spurry	fleabane, Canada	lady's thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed, common	ragweed, giant	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada	Crop Tolerance
Soil Applied and Early Postemergence Tank-Mixes																																
DUAL II MAGNUM + (BANVEL II **or** ORACLE **or** HAWKEYE)	x	x	✓	9	9	9	8[2]	8	8	8	9	2	9	9	9	8	9	9	6	9	9	9	9[4]	9[4]	8[4]	0	0	8[1,2]	0	9[4]	8[4]	G
DUAL II MAGNUM + BROADSTRIKE RC	x	x	✓	9	9	9	8[2]	8	8	8	9	2	–	4	–	7[R]	8	9[R]	8	7[R]	9[R]	8[R]	7[R]	9	–	8	–	–	–	–	–	G
DUAL II MAGNUM + CALLISTO + AATREX	x	x	✓	9	9	9	8[2]	8	8	8	9	4	9	8	–	8	9	9	9	9	9	9	8[4]	9	2	0	0	8[1,2]	0	0	0	E
DUAL II MAGNUM + MARKSMAN	x	x	✓	9	9	9	8[2]	8	8	8	9	2	9	9	9	9	9	9	9	9	9	9	9[4]	9[4]	8[4]	0	0	8[1,2]	0	8[4]	8[4]	G
FRONTIER MAX + AATREX	x	x	✓	9	9	9	8[2]	8	9	9	9	4	9	6	9	5	9	9[R]	9	9	9	9[R]	6	5	2	0	0	8[1,2]	2	2	0	E
FRONTIER MAX + BANVEL II	x	x	✓	9	9	9	8[2]	8	8	8	9	2	9	9	9	8	9	9	6	9	9	9	9[4]	9[4]	8[4]	0	0	8[1,2]	0	9[4]	8[4]	G
FRONTIER MAX + MARKSMAN	x	x	✓	9	9	9	8[2]	8	8	8	9	2	9	9	9	9	9	9	9	9	9	9	9[4]	9[4]	8[4]	0	0	8[1,2]	0	8[4]	8[4]	E
(PRIMEXTRA II **or** MAGNUM) + (BANVEL II **or** ORACLE **or** HAWKEYE)	x	x	✓	9	9	9	8[2]	8	8	8	9	2	9	9	9	9	9	9	9	9	9	9	9[4]	9[4]	8[4]	0	0	8[1,2]	0	8[4]	8[4]	G
PRIMEXTRA II MAGNUM + (CALLISTO **or** LUMAX)	✓	✓	✓	9	9	9	8[2]	8	8	8	9	4	9	8	7[4]	8	9	9	9	9	9	9	8[4]	9	2	0	0	8[1,2]	0	0	0	E
PROWL H2O + AATREX	x	x	✓	9	8	8	9	8	8	8	7	5	9	7	9	5	9	9	9	9	9	9[R]	6	6	2	–	–	–	2	2	–	E

[1] PPI timing is needed to achieve this level of control.

[2] Use the high rate of herbicide for optimum control.

[3] Use PRE timing for optimum control.

[4] Weed must be emerged to achieve this level of control.

[5] For use on all sweet corn varieties, however not all varieties have been tested. Contact the variety manufacturer for more information on the tolerance of a specific variety.

[6] Various formulations available, see Table 4–1. *Herbicides Used in Ontario*, page 30. See label for specific uses and rates.

[7] The addition of atrazine is required to achieve this level of control.

TABLE 9–1. Conventional Corn (Field, Seed and Sweet) Herbicide Weed Control Ratings (cont'd)

LEGEND: Numbers (0–9) = weed control ratings
✓ = can be used on this crop
R = populations resistant to this herbicide exist in Ontario and won't be adequately controlled if present

Crop tolerance ratings: E = Excellent, G = Good, F = Fair, P = Poor
x = not indicated for use on this crop

– = insufficient information available to make a rating
* = sold as a co-pack under this trade name

	Crop			Annual Grasses									Annual Broadleaves												Perennials							
Trade Name	seed corn	sweet corn	field corn	barnyard grass	smooth crabgrass	large crabgrass	fall panicum	foxtail, giant	foxtail, green	foxtail, yellow	witchgrass	proso millet	buckwheat, wild	cocklebur	corn spurry	fleabane, Canada	lady's thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed, common	ragweed, giant	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada	Crop Tolerance
Soil Applied and Early Postemergence Tank-Mixes (cont'd)																																
PROWL H20 + (BANVEL II **or** ORACLE **or** HAWKEYE)	x	x	✓	9	8	8	9	8	8	8	–	5	8	9	8	8	9	9	6	9	9	9	9[4]	9[4]	–	–	–	–	–	–	–	E
PROWL H20 + MARKSMAN	x	x	✓	9	8	8	9	8	8	8	8	5	9	9	9	9	9	9	9	9	9	9	9[4]	9[4]	–	–	–	–	–	–	–	E
Postemergence Grass Herbicides																																
ACCENT	✓	✓[5]	✓	9	0	7/8	9	9^R	9^R	8	9	9	0	0	0	0	0	0	0	0	9^R	0	0	0	0	0	0	0	9	0	0	E
ULTIM	x	x	✓	9	0	7/8	9	9^R	9^R	7	9	9	–	–	–	–	5	5	7	2	9^R	–	–	5	–	–	7	–	9	–	–	G
Postemergence Broadleaf Herbicides																																
2,4-D AMINE[6]	x	x	✓	0	0	0	0	0	0	0	0	0	4	8	2	7	4	9	9	7	9	8	–	8	7	0	0	0	0	8	8	F
2,4-DB (CALIBER **or** COBUTOX **or** EMBUTOX)	x	x	✓	0	0	0	0	0	0	0	0	0	4	8	0	–	0	7	8	7	9	8	–	8	8	0	0	0	0	8	8	G
AATREX + crop oil	✓	✓	✓	4	4	4	0	4	4	4	4	4	9	6	9	4	9	9^R	9	9	9^R	9^R	8	7	7	5	2	5	5	7	2	G
BANVEL II **or** ORACLE **or** HAWKEYE	x	x	✓	0	0	0	0	0	0	0	0	0	9	9	9	9	9	9	6	9	9	9	9	9	8	0	0	0	0	9	8	G
BASAGRAN FORTÉ	✓	✓	✓	0	0	0	0	0	0	0	0	0	7	9	9	5	9	7	9	7	8^R	8	8	9	6	0	0	6	0	6	8	E
BUCTRIL M **or** BADGE **or** MEXTROL **or** LOGIC M	x	✓	✓	0	0	0	0	0	0	0	0	0	9	9	–	6	9	9	9	9	8	9	–	9	7	7	0	0	0	7	7	F
CALLISTO + AATREX	✓	✓	✓	2	0	8	0	2	2	2	2	2	8	8	–	8	9	9	9	9	9	8	7	9	2	0	0	0	0	0	0	E
DISTINCT	x	x	✓	–	–	–	–	–	–	–	–	–	9	8	9	8	9	9	6	9	9	9	9	9	8	0	0	0	0	9	9	E

[1] PPI timing is needed to achieve this level of control.
[2] Use the high rate of herbicide for optimum control.
[3] Use PRE timing for optimum control.
[4] Weed must be emerged to achieve this level of control.
[5] For use on all sweet corn varieties, however not all varieties have been tested. Contact the variety manufacturer for more information on the tolerance of a specific variety.
[6] Various formulations available, see Table 4–1. *Herbicides Used in Ontario*, page 30. See label for specific uses and rates.
[7] The addition of atrazine is required to achieve this level of control.

TABLE 9–1. Conventional Corn (Field, Seed and Sweet) Herbicide Weed Control Ratings (cont'd)

LEGEND: Numbers (0–9) = weed control ratings
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x = not indicated for use on this crop
– = insufficient information available to make a rating
* = sold as a co-pack under this trade name

	Crop			Annual Grasses									Annual Broadleaves												Perennials							
Trade Name	seed corn	sweet corn	field corn	barnyard grass	smooth crabgrass	large crabgrass	fall panicum	foxtail, giant	foxtail, green	foxtail, yellow	witchgrass	proso millet	buckwheat, wild	cocklebur	corn spurry	fleabane, Canada	lady's thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed, common	ragweed, giant	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada	Crop Tolerance
Postemergence Broadleaf Herbicides (cont'd)																																
(IMPACT **or** ARMEZON) + AATREX	✓	✓	✓	7	7	7	7	8	7	7	7	7	8	7	–	6	9	9	9	9	9	9	9	7	–	–	–	–	–	–	–	E
MARKSMAN	x	x	✓	7	0	0	0	7	7	7	7	0	9	9	9	9	9	9	9	9	9	9	9	9	8	0	0	0	0	8	8	E
MCPA[6]	x	x	✓	0	0	0	0	0	0	0	0	0	2	7	7	7	0	9	9	–	7	9	–	7	7	6	0	0	0	7	7	P
PARDNER **or** BROMOTRIL **or** BROTEX **or** KORIL	✓	✓	✓	0	0	0	0	0	0	0	0	0	9	7	–	–	9	9	8	9	8^R	9	–	9	7	0	0	0	0	7	7	E
PEAK	✓	x	✓	0	0	0	0	0	0	0	0	0	–	9	–	–	9	9	9	–	9	9	9	9	–	–	–	0	0	–	–	E
PERMIT	x	✓	✓	0	0	0	0	0	0	0	0	0	–	8	–	8^R	8	8^R	8	–	8^R	8^R	8^R	8	–	–	–	8	0	–	–	E
TROPOTOX PLUS **or** CLOVITOX PLUS **or** TOPSIDE	x	x	✓	0	0	0	0	0	0	0	0	0	8	8	0	–	0	7	8	7	9	9	–	9	8	7	0	0	0	8	8	G
Postemergence Tank-Mixes																																
ACCENT + BANVEL II	x	x	✓	9	0	7/8	9	9^R	9^R	8	9	9	9	9	9	9	9	9	6	9	9	9	–	9	8	0	0	0	9	9	8	G
ACCENT + CALLISTO + AATREX	✓	✓[5]	✓	9	0	7/8	9	9^R	9^R	8	9	9	8	8	–	8	9	9	9	9	9	8	–	9	2	0	0	0	9	0	0	E
ACCENT + (DISTINCT **or** ACCENT TOTAL*)	x	x	✓	9	0	7/8	9	9^R	9^R	8	9	9	9	8	9	8	9	9	6	9	9	9	9	9	8	0	6	0	9	9	9	E
ACCENT + MARKSMAN	x	x	✓	9	0	7/8	9	9^R	9^R	7	9	9	9	9	9	9	9	9	9	9	9	9	9	9	8	0	0	0	9	8	8	E

[1] PPI timing is needed to achieve this level of control.
[2] Use the high rate of herbicide for optimum control.
[3] Use PRE timing for optimum control.
[4] Weed must be emerged to achieve this level of control.
[5] For use on all sweet corn varieties, however not all varieties have been tested. Contact the variety manufacturer for more information on the tolerance of a specific variety.
[6] Various formulations available, see Table 4–1. *Herbicides Used in Ontario*, page 30. See label for specific uses and rates.
[7] The addition of atrazine is required to achieve this level of control.

TABLE 9–1. Conventional Corn (Field, Seed and Sweet) Herbicide Weed Control Ratings (cont'd)

LEGEND: Numbers (0–9) = weed control ratings
✓ = can be used on this crop
R = populations resistant to this herbicide exist in Ontario and won't be adequately controlled if present
Crop tolerance ratings: E = Excellent, G = Good, F = Fair, P = Poor
x = not indicated for use on this crop
– = insufficient information available to make a rating
* = sold as a co-pack under this trade name

	Crop			Annual Grasses									Annual Broadleaves												Perennials							
Trade Name	**seed corn**	**sweet corn**	**field corn**	**barnyard grass**	**smooth crabgrass**	**large crabgrass**	**fall panicum**	**foxtail, giant**	**foxtail, green**	**foxtail, yellow**	**witchgrass**	**proso millet**	**buckwheat, wild**	**cocklebur**	**corn spurry**	**fleabane, Canada**	**lady's thumb**	**lamb's-quarters**	**mustards**	**nightshades**	**pigweeds**	**ragweed, common**	**ragweed, giant**	**velvetleaf**	**bindweed, field**	**horsetail**	**milkweed**	**nutsedge**	**quackgrass**	**sow-thistle**	**thistle, Canada**	**Crop Tolerance**
Postemergence Tank-Mixes (cont'd)																																
ACCENT + (PARDNER **or** BROMOTRIL **or** BROTEX **or** KORIL)	x	x	✓	9	0	7/8	9	9^{R}	9^{R}	8	9	9	9	7	–	–	9	9	8	9	8	9	–	9	7	0	0	0	9	7	7	E
AATREX + (BANVEL II **or** ORACLE **or** HAWKEYE)	x	x	✓	4	4	4	0	4	4	4	4	4	9	9	9	9	9	9	9	9	9	9	9	9	8	5	2	5	5	9	8	G
AATREX + (BUCTRIL M **or** BADGE **or** MEXTROL **or** LOGIC M)	x	x	✓	4	4	4	0	4	4	4	4	4	9	9	9	6	9	9	9	9	9	9	–	9	7	7	2	5	5	7	7	G
AATREX + BROMOXYNIL[6]	✓	✓	✓	4	4	4	0	4	4	4	4	4	9	7	9	9	9	9	9	9	9	9	–	9	7	5	2	5	5	7	2	E
(BANVEL II **or** ORACLE **or** HAWKEYE) + 2,4-D AMINE[7]	x	x		0	0	0	0	0	0	0	0	0	9	9	9	9	9	9	9	9	9	9	9	9	8	0	0	0	0	9	8	F
BANVEL II + BROMOXYNIL[6]	x	x	✓	0	0	0	0	0	0	0	0	0	9	9	9	9	9	9	8	9	9	9	–	9	8	0	0	0	0	9	8	G
DESTRA (sold as co-pack)	x	x	✓	9	0	7/8	9	9^{R}	9^{R}	7	9	5	8	8	–	8	9	9	9	9	9	8	7	9	2	0	0	6	9	6	2	E
OPTION + AATREX	x	x	✓	9	0	7	9	9^{R}	9^{R}	7	9	9	9	6	–	6	9	9^{R}	9	9	9^{R}	9	–	9	7	5	2	5	7/8	7	2	E
OPTION + BANVEL II	x	x	✓	9	0	7	9	9^{R}	9^{R}	8	9	9	9	9	9	9	9	9	9	9	9	9	–	9	8	0	0	0	9	9	8	E
OPTION + CALLISTO + AATREX	x	x	✓	9	0	7	9	9^{R}	9^{R}	8	9	9	8	8	–	8	9	9	9	9	9	9	8	9	2	0	0	0	9	0	0	E

[1] PPI timing is needed to achieve this level of control.
[2] Use the high rate of herbicide for optimum control.
[3] Use PRE timing for optimum control.
[4] Weed must be emerged to achieve this level of control.
[5] For use on all sweet corn varieties, however not all varieties have been tested. Contact the variety manufacturer for more information on the tolerance of a specific variety.
[6] Various formulations available, see Table 4–1. *Herbicides Used in Ontario*, page 30. See label for specific uses and rates.
[7] The addition of atrazine is required to achieve this level of control.

TABLE 9–1. Conventional Corn (Field, Seed and Sweet) Herbicide Weed Control Ratings (cont'd)

LEGEND: Numbers (0–9) = weed control ratings Crop tolerance ratings: E = Excellent, G = Good, F = Fair, P = Poor – = insufficient information available to make a rating
✓ = can be used on this crop x = not indicated for use on this crop * = sold as a co-pack under this trade name
R = populations resistant to this herbicide exist in Ontario and won't be adequately controlled if present

	Crop			Annual Grasses									Annual Broadleaves													Perennials							
Trade Name	**seed corn**	**sweet corn**	**field corn**	**barnyard grass**	**smooth crabgrass**	**large crabgrass**	**fall panicum**	**foxtail, giant**	**foxtail, green**	**foxtail, yellow**	**witchgrass**	**proso millet**	**buckwheat, wild**	**cocklebur**	**corn spurry**	**fleabane, Canada**	**lady's thumb**	**lamb's-quarters**	**mustards**	**nightshades**	**pigweeds**	**ragweed, common**	**ragweed, giant**	**velvetleaf**	**bindweed, field**	**horsetail**	**milkweed**	**nutsedge**	**quackgrass**	**sow-thistle**	**thistle, Canada**	**Crop Tolerance**
Postemergence Tank-Mixes (cont'd)																																
OPTION + DISTINCT	x	x	✓	9	0	7	9	9^R	9^R	8	9	9	8	8	9	8	9	9	9	9	9	9	9	9	8	0	0	0	9	0	0	E
OPTION + MARKSMAN	x	x	✓	9	0	7	9	9^R	9^R	7	9	9	9	9	9	9	9	9	9	9	9	9	9	9	8	–	–	0	7/8	8	8	E
OPTION + bromoxynil[6]	x	x	✓	9	0	7	9	9^R	9^R	7	9	9	9	7	–	9	9	9	9	9	9	9	–	9	7	5	2	5	8	7	5	E
PROWL H2O + ACCENT + BANVEL II **or** ORACLE **or** HAWKEYE	x	x	✓	9	9	9	9	8	8	8	9	7	8	9	8	9	9	9	6	9	9	9	9	8	–	–	–	–	–	–	–	G
ULTIM + (BANVEL II **or** ORACLE **or** HAWKEYE)	x	x	✓	9	0	7/8	9	9^R	9^R	7	9	9	9	9	9	9	9	9	7	9	9	9	9	9	8	0	0	0	9	9	8	G
ULTIM + CALLISTO + AATREX	x	x	✓	9	0	7/8	9	9^R	9^R	7	9	9	8	8	–	8	9	9	9	9	9	8	8	9	–	–	7	–	9	–	–	G
ULTIM + DISTINCT **or** ULTIM TOTAL*	x	x	✓	9	0	7/8	9	9^R	9^R	7	9	9	9	8	9	8	9	9	7	9	9	9	9	9	8	8	6	0	9	9	9	G
ULTIM + MARKSMAN	x	x	✓	9	0	7/8	9	9^R	9^R	7	9	9	9	9	9	9	9	9	9	9	9	9	9	9	8	0	0	0	9	8	8	G
ULTIM	x	x	✓	9	0	7/8	9	9^R	9^R	7	9	9	9	8	7	–	9	9	8	9	8	9	–	9	7	0	0	0	9	7	7	G
ULTIM + AATREX	x	x	✓	9	0	7/8	9	9^R	9^R	7	9	9	9	8	7	9	9	9	9	9	9	9	–	9	7	5	2	5	9	7	2	G

[1] PPI timing is needed to achieve this level of control.
[2] Use the high rate of herbicide for optimum control.
[3] Use PRE timing for optimum control.
[4] Weed must be emerged to achieve this level of control.
[5] For use on all sweet corn varieties, however not all varieties have been tested. Contact the variety manufacturer for more information on the tolerance of a specific variety.
[6] Various formulations available, see Table 4–1. *Herbicides Used in Ontario*, page 30. See label for specific uses and rates.
[7] The addition of atrazine is required to achieve this level of control.

TABLE 9–2. Additional Weed Control Ratings for Conventional Corn (Field, Seed and Sweet)

LEGEND: * = herbicides sold as a co-pack under this trade name

Weed Species	Timing	Herbicides (control rating — out of 10)
atriplex, spreading	Preemergence	CONVERGE XT* (7), MARKSMAN (6)
	Postemergence	PARDNER + AATREX (9), MARKSMAN (7), BANVEL II/ORACLE (6), DISTINCT (5), AATREX + oil (2)
adzuki beans, volunteer	Postemergence	CALLISTO + AATREX (9), DISTINCT (9)
bur-cucumber	Preemergence	AATREX (5), CONVERGE XT* (5), MARKSMAN (5), PRIMEXTRA II MAGNUM (5)
	Postemergence	PARDNER + AATREX (8), PEAK + BANVEL II (7), MARKSMAN (6), LADDOCK (6), AATREX + oil (5), CALLISTO + AATREX (4), BANVEL II/ORACLE (2), DISTINCT (2)
clover, red (volunteer)	Postemergence	BANVEL II/ORACLE (9), DISTINCT (9), MARKSMAN (9)
dandelion	Postemergence	OPTION + DISTINCT (7), DISTINCT (7)
flower of an hour	Postemergence	BANVEL II/ORACLE (9), MARKSMAN (9), PARDNER + AATREX (8), AATREX + oil (7), DISTINCT (2)
horsenettle	Postemergence	ULTIM + DISTINCT (8), ULTIM + MARKSMAN/PROPERO (7), DISTINCT (5)
prickly lettuce	Postemergence	ULTIM + DISTINCT (9), BATTALION* (9), MARKSMAN (9), PEAK + BANVEL II (8), BANVEL II/ORACLE (8), DISTINCT (8), PARDNER + AATREX (8)
red top	Postemergence	OPTION (9), ULTIM (9), ACCENT (8)
sandbur	Preemergence	DUAL II MAGNUM (5), FRONTIER MAX (5), PROWL H20 (5)
	Postemergence	OPTION (9), ULTIM (8), ACCENT (7)
stink and tufted love grass	Preemergence	DUAL II MAGNUM (9), FRONTIER MAX (9), PROWL H20 (9)
	Postemergence	ACCENT (9), ULTIM (9)
swamp smartweed	Preemergence	CALLISTO + AATREX (4), CONVERGE XT (4), MARKSMAN (3), AATREX (2)
	Postemergence	PEAK + BAVVEL II (6), BANVEL II/ORACLE (6), DISTINCT (5), MARKSMAN (3), PARDNER + AATREX (1), AATREX + oil (0)
three-seeded mercury	Preemergence	CALLISTO + AATREX (9), CONVERGE XT1(9), MARKSMAN (9), AATREX (9)
	Postemergence	AATREX + oil (9), DISTINCT (9), MARKSMAN (9), PARDNER + AATREX (9), BANVEL II/ORACLE (7), CALLISTO + AATREX (0)
waterhemp	Preemergence	CALLISTO + AATREX (9), CONVERGE XT* (9), PRIMEXTRA II MAGNUM (9), MARKSMAN (8), DUAL II MAGNUM (6), FRONTIER MAX (6)
	Postemergence	BANVEL II/ORACLE (9), CALLISTO + AATREX (9), DISTINCT (9), MARKSMAN (9), PARDNER + AATREX (9), AATREX + oil (0)
wild carrot	Postemergence	MARKSMAN (9), PEAK + BAVVEL II (9), CALLISTO + AATREX (8), DISTINCT (8), ULTIM OR ACCENT + CALLISTO + AATREX (8), PARDNER + AATREX (7), BANVEL II/ORACLE (6), AATREX + oil (2)
wirestem muhly	Postemergence	OPTION (9), ULTIM (6), ACCENT (6)
wood-sorrel	Preemergence	AATREX (9), CONVERGE XT* (9), MARKSMAN (9)
	Postemergence	AATREX + oil (9), BANVEL II/ORACLE (9)
vetch, tufted	Postemergence	BANVEL II/ORACLE (8), DISTINCT (8), MARKSMAN (8), CALLISTO + AATREX (6)
volunteer wheat	Postemergence	BATTALION (8), ACCENT (8), OPTION (8), ULTIM (8) – cereals must be at tillering or smaller to achieve this level of control

Conventional Corn (Field, Seed and Sweet)

Critical Stage: The Critical Stage to control weeds in corn is the 2–8 leaf over stage (3–10 leaf tips).

Apply all treatments in 150–300 L/ha (60–120 L/acre) water unless otherwise specified.

Cultural and Organic Control Methods

Any single method of weed control or the continuous use of the same herbicides can lead to the build-up of weeds resistant or tolerant to that control method. Triazine-resistant lamb's-quarters and pigweed, for example, are problematic due to continuous corn and repeated use of triazine herbicides. Rotating to other crops and/or other control methods reduces the chance of new or unique weed infestations.

To control small annual weed seedlings, blind harrow with a set of light harrows at a shallow depth before the corn has emerged, or use a weeder harrow (with L-shaped flexible tines) when the crop is 5–10 cm high. High speed (10 km/h), shallow (2.5–3 cm) cultivation with the rotary hoe when corn is 7–8 cm high also helps control small weed seedlings. These techniques will not reduce herbicide action and often enhances weed control. Inter-row cultivation can be used to complement other weed control measures. Row cultivation is most effective when weeds are small. Shallow cultivation will reduce: germination of new weed seeds, moisture loss and corn root injury.

Inter-row cultivation may be required when weeds escape herbicide treatment; consider weeds escapes when they are 5–7 cm high.

Cultivation gives some control of established perennial weeds but may also help to spread them to previously uninfested areas. Machinery sanitation is important when moving from one field to another. Many perennials (e.g., quackgrass) can be spread on tillage equipment. Machinery operators should be particularly careful when moving from one farm to another.

Seed Corn

Some field corn registrations are applicable to seed corn, however, certain inbreds are susceptible to some herbicides. Check with the contracting company before applying any herbicide. For information on specific weeds see Table 9–1. *Conventional Corn (Field, Seed and Sweet) Herbicide Weed Control Ratings,* page 127, and then refer to the appropriate section for details about herbicide treatment.

Mixing Herbicides With Nitrogen

Nitrogen solution can be used as a carrier, instead of water, for preplant and preemergence application of some herbicides. Weed control activity is not increased. Spray before crop emergence. Consult the herbicide label for proper methods of application and use of dispersing agents. Calibrate the sprayer to apply the required amount of nitrogen. Use stainless steel flood jet nozzles of adequate size. Nitrogen solution is mildly corrosive, especially to brass; clean the sprayer immediately after use. UNITE may be used to improve liquid fertilizer herbicide compatibility and stability when a simultaneous application of a liquid fertilizer and liquid or wettable powder herbicide is desired. Because formulations and rates vary, it is essential to read the label to determine the exact amount and method to be used.

Do not apply nitrogen solution with postemergence herbicides as significant crop injury and reduced weed control can occur.

Special Notes For Corn, Field and Sweet

PRECAUTIONS: Do not use 2,4-D, MCPA, MCPB, 2,4-DB or dicamba later than 2 weeks prior to the first appearance of tassels or ear silk. Use extreme care when applying these herbicides near susceptible crops because of possible herbicide movement. Soybeans, tomatoes and tobacco are extremely sensitive to dicamba and injury symptoms may persist for several weeks. Do not use dicamba in the area of susceptible crops when temperatures exceed 25°C on the day of application or if high humidity is expected, due to the possibility of dicamba volatilizing and injuring susceptible crops nearby. Leave several rows of corn unsprayed when adjacent to soybean fields or other susceptible crops.

Atrazine and Simazine Soil Residues

Atrazine and simazine residues may last for more than one year, particularly if high rates are used more than once and dry weather occurs. If atrazine or simazine is used year after year as in a continuous corn program, triazine residues may be higher. Atrazine when used at rates of 1 kg/ha (active ingredient) or lower on corn do not cause injury to succeeding crops of oats, barley, mixed grains, or soybeans. However certain crops are sensitive when grown the year after Atrazine has been applied at rates above 1 kg/ha (active ingredient). Refer to the product label and Tables 4–4 and 4–5. *Herbicide Crop Rotation and Soil pH Restrictions,* page 74 and page 76 for specific rotational crop restrictions.

Injury has been reported on tomatoes, white beans, forage seedlings, peas, tobacco, cucumbers, onions, and turnips following applications of atrazine at more than 1.1 kg/ha (active ingredient) on corn the previous year.

To reduce the hazard of atrazine residues on succeeding crops:

- Fall plowing will reduce triazine injury more than spring plowing will.

- Deeper tillage will reduce the concentration of herbicide in the upper soil area compared to shallow tillage.
- Ensure that the sprayer used is adequate and is properly calibrated and adjusted. Spray uniformly without overlaps and do not spray while the sprayer is stopped.

Herbicide Treatments Include

- Preplant (PP) – Also see Chapter 6 *Preplant & Postharvest Weed Control*, page 91, for details of products, rates and remarks.
- Preplant Incorporated (PPI) – Two incorporations at right angles operating at a depth of 10 cm using a double disk (7–10 km/h) or vibrating shank S-tine cultivator (10–13 km/h) are required unless otherwise stated on a product's label. Cultivation equipment used for herbicide incorporation are known to spread perennial weeds to previously uninfested areas. Pay special attention to machinery cleanliness, and treat fields with perennial weeds last.
- Preemergence (PRE) – Rainfall of 15–20 mm within 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing controls weed escapes and improves herbicide activity in the absence of rainfall.
- Postemergence (POST) –Apply herbicide when weeds are small and actively growing. Avoid applying herbicides past the maximum weed leaf stage listed on the label or control will be reduced. Crop stage is important to optimize crop safety. Adjuvants will frequently improve the weed control when used as directed. Weather or other conditions may influence the optimum rate of adjuvant, see the product label for more details. Always use appropriate drift management technology.

Corn Leaf Stages

Counting leaves on a corn plant may sound like an easy task, but there are complications that can cause miscounting. There are several methods of counting leaves. It is important to know which leaf counting method is being referred to.

This publication uses the leaf over method, (see Figure 9–1, on this page) where counting starts with leaves that have emerged from the whorl and the leaf tip is starting to arch over. This normally occurs when leaves are about 50% emerged. Most product labels also use this method of leaf counting, but check the label or with the product representative to be sure. The comparative growth stages table in the next column gives a comparison among the count methods.

Another complication with leaf counting is where on the plant leaf counting begins. In this publication, the first leaf is the bottom leaf of the plant. The first leaf is shorter than other leaves and has a round leaf tip. However, as the plant grows the bottom leaves die and drop to the ground. For example, a 10 leaf corn plant may be incorrectly identified as a 7 leaf corn plant because 3 leaves may be "senesced" or fallen off. These leaves may not be immediately apparent and care must be taken to count them.

Start counting from the bottom leaf and check the first leaf to look for the rounded leaf tip.

It takes about 75–80 Crop Heat Units to produce each corn leaf. Therefore at temperatures of 30°C day, and 20°C at night, there is one new leaf every 2–3 days; and at 20°C day, and 10°C at night, one new leaf every 5–6 days.

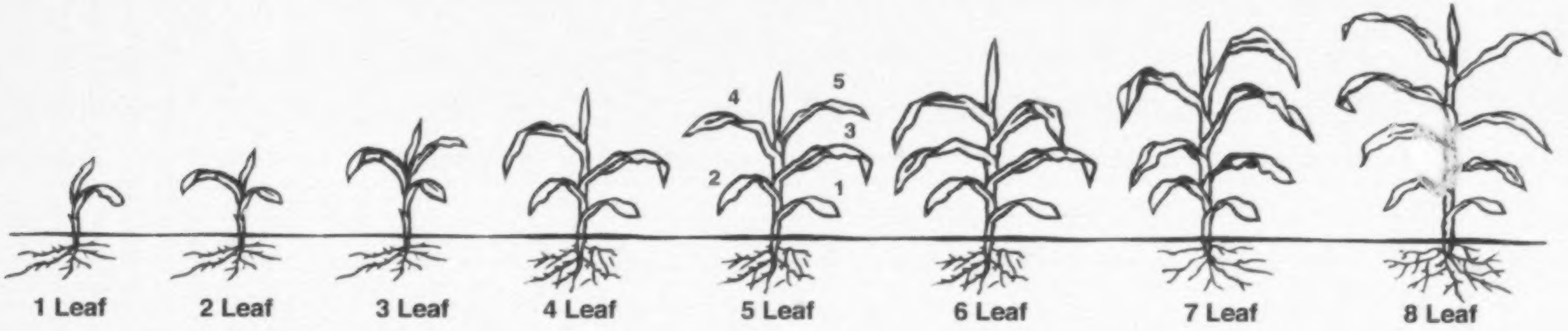

FIGURE 9–1. Leaf Over Method of Counting Corn Leaves.

Some product labels also use plant height to indicate crop growth stages. In general, plant height is more variable depending on plant genetics and on the weather of the season. The following Table 9–3 gives some comparative heights for each leaf stage but individual plants may be slightly more or less than the stage given depending on genetics and weather. The standing height is measured from the ground surface to the top of the plant as it stands. Leaf extended refers to the height of the plant with the leaves pulled up to their full height.

TABLE 9–3.
Comparative Growth Stages

Leaf Over[1]	Leaf Collar	Leaf Tip[2]	Standing Height (cm)	Leaf Extended (cm)
2	1	3	5–6	5–11
4	3	5–6	9–17	16–25
6	4–5	7–8	18–33	29–46
8	5–6	9–10	36–54	54–77
10	8	12	58–85	86–112
12	10	14–15	99–114	121–149

[1] Number of leaf tips emerged from the whorl.
[2] Number of leaf whorls emerged from the whorl.

TABLE 9-4. Herbicide Treatment Rates for Conventional Corn (Field, Seed and Sweet)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Preplant Burndown and Residual Control			
Non-selective herbicides such as glyphosate and GRAMAXONE are used to control emerged weeds prior to no-till planting. Tank-mixing of a residual herbicide with glyphosate or GRAMAXONE can be used to improve application efficiency with a "one pass" weed management program. Refer also to Chapter 6, *Preplant & Postharvest Weed Control*, page 91 for preplant application rates for glyphosate and GRAMAXONE. It is also important to note that when targeting perennial weeds, the addition of a triazine-based herbicide (e.g., AATREX, CONVERGE 480, MARKSMAN, PRIMEXTRA II MAGNUM) will reduce the level of acretivity acrehieved with glyphosate. Increasing the rate of glyphosate should overcome this antagonism.			
Soil Applied Grass and Broadleaf Herbicides (Preemergence Timing Only)			
saflufenacil/ dimethenamid-P (735 g/ha)	INTEGRITY (668 g/L)	1.1 L/ha (0.44 L/acre)	· Apply PPI or PRE. · A PPI application is required for the control of yellow nutsedge and Eastern black nightshade. · **Do NOT** incorporate greater than 3 cm deep or control will be reduced. · INTEGRITY may be used with liquid fertilizer as a carrier. Conduct a liquid fertilizer compatibility test by mixing a small quantity of herbicide with a proportional quantity of liquid fertilizer in a jar prior to loading a spray tank.
carfentrazone-ethyl (15.6–21.6 g/ha) + pyroxasulfone (125–150 g/ha)	FOCUS (sold as a co-pack): AIM EC (240g/L) + PYROXASULFONE (85 WG)	60–90 mL/ha (24–36 mL/acre) + 118–178 g/ha (48–72 g/acre)	· **Do NOT use on seed or sweet corn.** · Apply PP or PRE. · **Do NOT** use on peat or muck soils and soils with 7% or more organic matter content. · Moisture is necessary to acretivate the active ingredient pyroxasulfone in soil for weed control. · The AIM EC component will only control emerged broadleaf weeds at application.
simazine (1.35–2.25 kg/ha)	PRINCEP NINE-T (90 WG)	1.5–2.5 kg/ha (0.6–1 kg/acre)	· These products are listed separately because of their widely differing rate ranges. In both cases the low rates should be used on sandy soils while the higher rates may be used on loams and clays. · Full season annual weed control can be expected except for crabgrass or fall panicum where infestations have built up. · Caution is advised when considering rates beyond 2.0 kg/ha (0.8 kg/acre) as high soil residues may be created and rotational crops may be affected.
simazine (1.6–4 kg/ha)	SIMADEX (500 g/L)	3.2–8 L/ha (1.28–3.2 L/acre)	
	SIMAZINE 480 (480 g/L)	3.4–8.3 L/ha (1.36–3.32 L/acre)	
Soil Applied Tank-Mixes (Preemergence Timing Only)			
s-metolachlor/benoxacor (1.14 kg/ha) + linuron (0.38–0.75 kg/ha) + atrazine (0.99–1.53 kg/ha)	DUAL II MAGNUM (915 g/L) + LOROX L (480 g/L) + AATREX (480 g/L)	1.25 L/ha (0.5 L/acre) + 0.79–1.56 L/ha (0.32–0.63 L/acre) + 2.06–3.19 L/ha (0.83–1.28 L/acre)	· Use **ONLY** on sweet corn. · Make **ONLY** one application per year. · Apply in a minimum of 150 L water/ha. · **Do NOT** harvest sweet corn within 50 days of treatment. · Apply by ground equipment **ONLY**.
s-metolachlor/ benoxacor/atrazine (2.16–2.88 kg/ha) + linuron (0.37–0.75 kg/ha)	PRIMEXTRA II MAGNUM ((1:0.8) 720 g/L) + LOROX L (480 g/L)	3–4 L/ha (1.2–1.6 L/acre) + 0.77–1.56 L/ha (0.31–0.63 L/acre)	· **Do NOT use on seed corn or sweet corn.** · This tank-mix can be used on light textured soils with organic matter greater than 1.0%. · Linuron controls triazine resistant lamb's-quarters and redroot pigweed. Fall panicum or velvetleaf may not be controlled for the full season.

TABLE 9–4. Herbicide Treatment Rates for Conventional Corn (Field, Seed and Sweet) (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Soil Applied Broadleaf Herbicides (Preemergence timing only)			
atrazine (1.01–1.49 kg/ha)	AATREX (480 g/L)	2.1–3.1 L/ha (0.84–1.24 L/acre)	• Apply PPI, PRE. • Weeds will normally emerge and die within a few days; atrazine can persist for varying lengths of time; longer under dry, cool weather and coarse textured soils. See tank-mixes for reducing rates and avoiding residues, and for treatments to provide annual grass control. • Can be tank-mixed with glyphosate or GRAMOXONE for PP burndown of emerged annual and perennial weeds, see Chapter 6, Preplant & Postharvest Weed Control, page 91 for more information.
atrazine (1.01–1.49 kg/ha) + dicamba (0.6 kg/ha)	AATREX (480 g/L) + BANVEL II (480 g/L) AATREX (480 g/L) + ORACLE (480 g/L) AATREX (480 g/L) + HAWKEYE (480 g/L)	2.1–3.1 L/ha (0.84–1.24 L/acre) + 1.25 L/ha (0.5 L/acre)	• Apply PRE. • **Do NOT use on seed corn or sweet corn.** • This treatment should provide good control of triazine resistant broadleaf weeds and velvetleaf. • See notes on atrazine with respect to residues, on page 135. • See precautions for BANVEL II, ORACLE or HAWKEYE applied alone, on this page. • **Do NOT** apply to coarse (sand) textured soils with less than 2% organic matter.
dicamba (0.6 kg/ha)	BANVEL II (480 g/L) ORACLE (480 g/L) HAWKEYE (480 g/L)	1.25 L/ha (0.5 L/acre)	• Apply PRE. • **Do NOT use on seed corn or sweet corn.** • If corn seed is less than 4 cm below the soil surface, delay application until the spike stage of corn. • Apply to medium to fine textured soils containing more than 2.5% organic matter. • **Do NOT** apply to coarse (sand) textured soils with less than 2% organic matter. • **Do NOT** incorporate.
flumetsulam (50 g/ha)	BROADSTRIKE RC (80%)	62.5 g/ha (25 g/acre)	• Apply PP, PPI or PRE. • **Do NOT use on seed corn or sweet corn.** • **Do NOT** use where the soil pH is greater than 7.8 or where the organic matter is less than 2%. • **Do NOT** apply to peat or muck soils or where the soil organic matter is greater than 5%. • **Do NOT** apply more then once a year.
mesotrione (0.140 kg/ha) + atrazine (1.0–1.49 kg/ha)	CALLISTO (480 g/L) + AATREX (480 g/L)	0.3 L/ha (0.12 L/acre) + 2.1–3.1 L/ha (0.85–1.25 L/acre)	• Apply PRE to field, seed or sweet corn. • For annual grass control and improved control of certain broadleaf weeds CALLISTO should be tank-mixed with Primextra II Magnum.
dicamba/atrazine (1.5–1.8 kg/ha)	MARKSMAN (393 g/L)	3.7–4.5 L/ha (1.5–1.8 L/acre)	• Apply PRE. • **Do NOT use on seed corn or sweet corn.** • See notes on atrazine with respect to residues, on page 135. • See precautions for BANVEL II, ORACLE or HAWKEYE applied alone, on this page. • **Do NOT** apply to coarse (sand) textured soils with less than 2% organic matter.

TABLE 9–4. Herbicide Treatment Rates for Conventional Corn (Field, Seed and Sweet) (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Soil Applied and Early Postemergence Grass Herbicides			
s-metolachlor/benoxacor (1.14–1.6 kg/ha)	DUAL II MAGNUM (915 g/L)	1.25–1.75 L/ha (0.5–0.7 L/acre)	• Apply PPI, PRE. • Apply POST (up to 3 leaf corn) on field corn **ONLY**. • For PPI timing, set incorporation equipment to work soil no deeper than 10 cm. • Improved control of yellow nutsedge is obtained when DUAL II MAGNUM is applied PPI. • Grassy weeds beyond the 2 leaf stage will not be controlled. • Optimal control of nightshade is obtained when DUAL II MAGNUM is applied PRE. • **Do NOT** use on muck, peat, or high organic matter soils. • See tank-mixes for treatments to provide annual broadleaf control or follow with sequential postemergence broadleaf herbicide. • Can be tank-mixed with glyphosate or GRAMOXONE for PP burndown of emerged annual and perennial weeds, see Chapter 6, Preplant & Postharvest Weed Control, page 91 for more information.
dimethenamid (544–693 g/ha)	FRONTIER MAX (720 g/L)	756–963 mL/ha (305–390 mL/acre)	• Apply PPI or PRE to seed, sweet and field corn. • Apply POST (up to 3 leaf corn) on field corn **ONLY**. • For PPI timing, set incorporation equipment to work soil no deeper than 10 cm. • Improved control of yellow nutsedge is obtained when FRONTIER MAX is applied PPI at the highest rate. • Sensitive weeds beyond the 2 leaf stage will not be controlled. • Apply higher rates on fine textured or high organic matter soils or when targeting nightshade, nutsedge and pigweed. • **Do NOT** use on muck, peat, or high organic matter soils. • See tank-mixes for treatments to provide annual broadleaf control or follow with sequential postemergence broadleaf herbicide. • **Maximum use rate** of FRONTIER MAX for seed corn is 756 mL/ha (305 mL/acre). • Consult the seed corn company for information on the tolerance of seed corn inbred lines prior to the use of FRONTIER MAX herbicide.
Preemergence and Early Postemergence Grass and Broadleaf Herbicides			
rimsulfuron (15 g/ha) + s-metolachlor/benoxacor (684 g/ha) + dicamba (360 g/ha)	BATTALION (sold as a co-pack): ELIM EP (25 DF) + DUAL II MAGNUM (915 g/L) + BANVEL II (480 g/L)	60 g/ha (24 g/acre) + 0.75 L/ha (0.3 L/acre) + 0.75 L/ha (0.3 L/acre)	• Apply PRE. • **Do NOT use on seed corn or sweet corn.** • See precautions for BANVEL II alone, page 139. • **Do NOT** incorporate. • BATTALION can be applied with 28% UAN as a carrier **(PRE only)**. • For suppression of quackgrass, apply BATTALION at the 1–6 leaf stage of quackgrass.
rimsulfuron (12.5 g/ha) + s-metolachlor/benoxacor (573 g/ha) + dicamba (300 g/ha) + non-ionic surfactant (0.2% v/v)	BATTALION (sold as a co-pack): ELIM EP (25 DF) + DUAL II MAGNUM (915 g/L) + BANVEL II (480 g/L) + non-ionic surfactant	50 g/ha (20 g/acre) + 0.625 L/ha (0.25 L/acre) + 0.625 L/ha (0.25 L/acre) + 2 L/1,000 L	• Apply POST from the spike to 3 leaf stage of field corn. • **Do NOT use on seed corn or sweet corn.** • See precautions for BANVEL II alone, page 139. • Refer to individual product labels for use precautions. • For suppression of quackgrass, apply BATTALION at the 1–6 leaf stage of quackgrass.

TABLE 9–4. Herbicide Treatment Rates for Conventional Corn (Field, Seed and Sweet) (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Preemergence and Early Postemergence Grass and Broadleaf Herbicides (cont'd)			
isoxaflutole (79–105 g/ha) + atrazine (0.8–1.063 kg/ha)	CONVERGE XT (sold as a co-pack): CONVERGE FLEXX (240 g/L) + CONVERGE 480 (480 g/L)	330–440 mL/ha (134–178 mL/acre) + 1.67–2.21 L/ha (0.67–0.89 L/acre)	• Apply PRE-PLANT or PRE to seed corn. • Not all seed corn inbred lines have been tested for tolerance to Converge Flexx. Use of this product must be approved by the contracting seed corn company and comply with their directions for use. • Apply PRE-PLANT, PRE or POST up to the 3 leaf stage of field corn. • **Do NOT** incorporate treatments prior to planting. • Use the higher application rates for control of fall panicum and proso millet. • CONVERGE XT is a co-pack of CONVERGE FLEXX and CONVERGE 480. • **Do NOT** use CONVERGE XT on sands, loamy sands and/or soils with less than 2% organic matter. • Can be tank-mixed with glyphosate for PP burndown of emerged annual and perennial weeds, see Chapter 6, Preplant & Postharvest Weed Control, page 91 for more information.
rimsulfuron (15 g/ha) + mesotrione (144 g/ha)	ENGARDE (sold as a co-pack): ENGARDE 25SG + ENGARDE 480SC	60 g/ha (24 g/acre) + 300 mL/ha (120 mL/acre)	• **Do NOT use on seed corn or sweet corn.** • Apply PRE or Early POST up to the 2 leaf stage of corn. • Engarde can be applied with 28% UAN as a carrier **(PRE only).** • Can be tank-mixed with glyphosate for emerged annual and perennial weeds. See Chapter 6, Preplant & Postharvest Weed Control, page 91 for more information.
s-metolachlor/ benoxacor/atrazine/ mesotrione (2,065 g/ha)	LUMAX EZ (298 g/L, 112 g/L, 30 g/L)	4.7 L/ha (1.9 L/acre)	• Apply surface pre-plant up to 7 days prior to planting, PRE or Early POST up to the 2 leaf stage of field corn. • Apply PRE to seed and sweet corn. • Grassy weeds beyond the 2 leaf stage will not be controlled. • **Do NOT** apply to corn treated with an organophosphorous insecticide.
s-metolachlor/ benoxacor/atrazine (2.16–2.88 kg/ha)	PRIMEXTRA II MAGNUM ((1:0.8) 720 g/L)	3–4 L/ha (1.2–1.6 L/acre)	• Apply PPI, PRE or POST up to the 3 leaf stage of corn. • Use the higher rate where annual grass build up or nutsedge infestation is evident. • Grassy weeds beyond the 2 leaf stage will not be controlled. • The equivant rate of PRIMEXTRA II MAGNUM can be acrehieved by adding DUAL II MAGNUM at 1.25 - 1.75 L/ha (0.5–0.7 L/acre) with AATREX at 2.1 - 3.1 L/ha (0.84–1.24 L/acre). • Can be tank-mixed with glyphosate or GRAMOXONE for PP burndown of emerged annual and perennial weeds, see Chapter 6, Preplant & Postharvest Weed Control, page 91 for more information.

TABLE 9–4. Herbicide Treatment Rates for Conventional Corn (Field, Seed and Sweet) (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Soil Applied and Early Postemergence Tank-Mixes (for Control of Grass and Broadleaf Weeds)			
flumetsulam (50 g/ha) + s-metolachlor/benoxacor (1.14–1.6 kg/ha)	BROADSTRIKE RC (80%) + DUAL II MAGNUM (915 g/L)	62.5 g/ha (25 g/acre) + 1.25–1.75 L/ha (0.5–0.7 L/acre)	· Apply PP, PPI, PRE or POST up to the 2 leaf stage of corn. · **Do NOT use on seed corn or sweet corn.** · See precautions for BROADSTRIKE RC alone, page 139 and DUAL II MAGNUM alone, page 140.
flumetsulam (50 g/ha) + s-metolachlor/benoxacor/atrazine (2.16–2.88 kg/ha)	BROADSTRIKE RC (80%) + PRIMEXTRA II MAGNUM ((1:0.8) 720 g/L)	62.5 g/ha (25 g/acre) + 3–4 L/ha (1.2–1.6 L/acre)	· Apply PP, PPI, PRE or POST up to the 2 leaf stage of corn. · **Do NOT use on seed corn or sweet corn.** · See precautions for BROADSTRIKE RC alone, page 139 and PRIMEXTRA II MAGNUM alone, on this page.
isoxaflutole (79–105 g/ha) + atrazine (0.8–1.063 kg/ha)	CONVERGE FLEXX + AATREX (480 g/L)	330–440 mL/ha (134–178 mL/acre) + 1.67–2.21 L/ha (0.67–0.89 L/acre)	· Apply PRE-PLANT, PRE or POST up to the 3 leaf stage of field corn. · Apply PRE-PLANT or PRE for seed corn. · Not all seed corn inbred lines have been tested for tolerance to Converge Flexx. Use of this product must be approved by the contracting seed corn company and comply with their directions for use. · **Do NOT use on sweet corn.** · **Do NOT** incorporate treatments prior to planting. · Use the higher application rates for control of fall panicum and proso millet. · **Do NOT** use CONVERGE FLEXX on sands, loamy sands and/or soils with less than 2% organic matter.
s-metolachlor/benoxacor (1.14–1.6 kg/ha) + dicamba (0.6 kg/ha)	DUAL II MAGNUM (915 g/L) + BANVEL II (480 g/L) DUAL II MAGNUM (915 g/L) + ORACLE (480 g/L) DUAL II MAGNUM (915 g/L) + HAWKEYE (480 g/L)	1.25–1.75 L/ha (0.5–0.7 L/acre) + 1.25 L/ha (0.5 L/acre)	· **Do NOT use on seed corn or sweet corn.** · Apply PRE or POST up to the 3 leaf stage of field corn. · Use higher rates on heavy grass infestations and for fall panicum. Fall panicum may not be controlled all season. · Grassy weeds beyond the 2 leaf stage will not be controlled. · See precautions for BANVEL II, ORACLE or HAWKEYE applied alone, page 139. · **Do NOT** apply to coarse (sand) textured soils with less than 2% organic matter.
s-metolachlor/benoxacor (1.14–1.6 kg/ha) + dicamba (0.6 kg/ha) + atrazine (1.01–1.49 kg/ha)	DUAL II MAGNUM (915 g/L) + BANVEL II (480 g/L) + AATREX (480 g/L) DUAL II MAGNUM (915 g/L) + ORACLE (480 g/L) + AATREX (480 g/L) DUAL II MAGNUM (915 g/L) + HAWKEYE (480 g/L) + AATREX (480 g/L)	1.25–1.75 L/ha (0.5–0.7 L/acre) + 1.25 L/ha (0.5 L/acre) + 2.1–3.1 L/ha (0.84–1.24 L/acre)	· **Do NOT use on seed corn or sweet corn.** · Apply PRE or POST up to the 3 leaf stage of field corn. · Use higher rates on heavy grass infestations and for fall panicum. Fall panicum may not be controlled all season. · Grassy weeds beyond the 2 leaf stage will not be controlled. · See precautions for BANVEL II, ORACLE or HAWKEYE applied alone, page 139. · **Do NOT** apply to coarse (sand) textured soils with less than 2% organic matter.

TABLE 9–4. Herbicide Treatment Rates for Conventional Corn (Field, Seed and Sweet) (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Soil Applied and Early Postemergence Tank-Mixes (for Control of Grass and Broadleaf Weeds) (cont'd)			
s-metolachlor/benoxacor (1.14–1.60 kg/ha) + mesotrione (0.140 kg/ha) + atrazine (1.0–1.49 kg/ha)	DUAL II MAGNUM (915 g/L) + CALLISTO (480 g/L) + AATREX (480 g/L)	1.25–1.75 L/ha (0.5–0.7 L/acre) + 0.3 L/ha (0.12 L/acre) + 2.1–3.1 L/ha (0.85–1.25 L/acre)	· Apply PRE to field, seed and sweet corn. · Apply PRE or POST up to the 3 leaf stage of field corn **ONLY**. · Use high rates for heavy grass infestations. · Grassy weeds beyond the 2 leaf stage will not be controlled. · **Do NOT** apply to corn treated with an organophosphorous insecticide.
s-metolachlor/benoxacor (1.14–1.6 kg/ha) + dicamba/atrazine (1.48–1.8 kg/ha)	DUAL II MAGNUM (915 g/L) + MARKSMAN (393 g/L)	1.25–1.75 L/ha (0.5–0.7 L/acre) + 3.7–4.5 L/ha (1.5–1.8 L/acre)	· **Do NOT use on seed corn or sweet corn.** · Apply PRE or POST up to the 3 leaf stage of field corn. · Use higher rates on heavy grass infestations and for fall panicum. Fall panicum may not be controlled all season. · Grassy weeds beyond the 2 leaf stage will not be controlled. · See precautions for BANVEL II, ORACLE or HAWKEYE alone, page 139. · **Do NOT** apply to coarse (sand) textured soils with less than 2% organic matter.
dimethenamid (544–693 g/ha) + atrazine (1–1.53 kg/ha)	FRONTIER MAX (720 g/L) + AATREX (480 g/L)	756–963 mL/ha (305–390 mL/acre) + 2.08–3.19 L/ha (0.832–1.28 L/acre)	· Apply PREPLANT, PPI, PRE or POST up to the 3 leaf stage of corn. · Use the higher rate of FRONTIER MAX for heavier weed populations. Control of non-emerged triazine resistant weeds will be limited to pigweed. · Grassy weeds beyond the 2 leaf stage will not be controlled. · Can be tank-mixed with glyphosate or GRAMOXONE for PP burndown of emerged annual and perennial weeds, see Chapter 6, Preplant & Postharvest Weed Control, page 91 for more information.
dimethenamid (544–693 g/ha) + dicamba (0.6 kg/ha)	FRONTIER MAX (720 g/L) + BANVEL II (480 g/L)	756–963 mL/ha (305–390 mL/acre) + 1.25 L/ha (0.5 L/acre)	· **Do NOT** use on seed corn, popcorn or sweet corn. · Apply PREPLANT, PRE or POST up to the 3 leaf stage of field corn. · Use the higher rate of FRONTIER MAX for heavier weed populations. For improved burndown control, the addition of glyphosate may be required. · Grassy weeds beyond the 2 leaf stage will not be controlled. · See precautions for BANVEL II, ORACLE or HAWKEYE applied alone, page 139.
dimethenamid (544–693 g/ha) + dicamba/atrazine (1.8 kg/ha)	FRONTIER MAX (720 g/L) + MARKSMAN (393 g/L)	756–963 mL/ha (305–390 mL/acre) + 4.5 L/ha (1.8 L/acre)	· **Do NOT** use on seed or sweet corn. · Apply PREPLANT, PRE or POST up to the 3 leaf stage of field corn. · Use the higher rate of FRONTIER MAX for heavier weed populations. For improved burndown control, adding glyphosate may be required. · Grassy weeds beyond the 2 leaf stage will not be controlled. · See precautions for BANVEL II, ORACLE or HAWKEYE applied alone, page 139.
s-metolachlor/benoxacor/atrazine (2.16–2.88 kg/ha) + mesotrione (0.140 kg/ha)	PRIMEXTRA II MAGNUM ((1:0.8) 720 g/L) + CALLISTO (480 g/L)	3–4 L/ha (1.2–1.6 L/acre) + 0.3 L/ha (0.12 L/acre)	· Apply PRE to seed and sweet corn. · Apply PRE or POST up to the 3 leaf stage of field corn. · Use high rates for heavy grass infestations. · Grassy weeds beyond the 2 leaf stage will not be controlled. · **Do NOT** apply to corn treated with an organophosphorous insecticide.

TABLE 9–4. Herbicide Treatment Rates for Conventional Corn (Field, Seed and Sweet) (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Soil Applied and Early Postemergence Tank-Mixes (for Control of Grass and Broadleaf Weeds) (cont'd)			
s-metolachlor/ benoxacor/atrazine (2.16–2.88 kg/ha) + dicamba (0.6 kg/ha)	PRIMEXTRA II MAGNUM ((1:0.8) 720 g/L) + BANVEL II (480 g/L)	3–4 L/ha (1.2–1.6 L/acre) + 1.25 L/ha (0.5 L/acre)	· **Do NOT use on seed corn or sweet corn.** · Apply PRE or POST up to the 3 leaf stage of field corn. · Use higher rates on heavy grass infestations and for fall panicum. Fall panicum may not be controlled all season. · Grassy weeds beyond the 2 leaf stage will not be controlled. · See precautions for BANVEL II, ORACLE or HAWKEYE alone, page 146. · **Do NOT** apply to coarse (sand) textured soils with less than 2% organic matter.
	PRIMEXTRA II MAGNUM ((1:0.8) 720 g/L) + ORACLE (480 g/L)		
	PRIMEXTRA II MAGNUM ((1:0.8) 720 g/L) + HAWKEYE (480 g/L)		
pendimethalin (1.68 kg/ha)	PROWL H20 (455 g/L)	3.7 L/ha (1.48 L/acre)	· **Do NOT use on seed corn or sweet corn.** · Apply PRE or POST up to the 4 leaf stage of field corn. · PROWL H20 alone will not control emerged weeds. Tank-mixing or use of a sequential herbicide program to acrehieve broad spectrum control is suggested. Plant corn at least 4 cm deep and ensure good seed coverage. PROWL H20 may be applied in water or liquid fertilizer as a carrier. Conduct a liquid fertilizer compatibility test with any of the registered PROWL H20 tank-mix combinations. If there is no rain within 7 days, rotary hoeing or shallow cultivation is required.
pendimethalin (1.68 kg/ha) + atrazine (1.53 kg/ha)	PROWL H20 (455 g/L) + AATREX (480 g/L)	3.7 L/ha (1.48 L/acre) + 3.19 L/ha (1.28 L/acre)	· **Do NOT use on seed corn or sweet corn.** · Apply PRE or POST up to the 4 leaf stage of field corn. · See precautions for PROWL H20 alone, page 144.
pendimethalin 1.68 kg/ha + dicamba (0.6 kg/ha)	PROWL H20 (455 g/L) + BANVEL II (480 g/L)	3.7 L/ha (1.48 L/acre) + 1.25 L/ha (0.5 L/acre)	· **Do NOT use on seed corn or sweet corn.** · Apply PRE or POST up to the 4 leaf stage of field corn. · See precautions for PROWL H20 alone, page 144, and BANVEL II, ORACLE or HAWKEYE alone, page 146.
	PROWL H20 (455 g/L) + ORACLE (480 g/L)		
	PROWL H20 (455 g/L) + HAWKEYE (480 g/L)		
pendimethalin (1.68 kg/ha) + dicamba/atrazine (1.48–1.8 kg/ha)	PROWL H20 (455 g/L) + MARKSMAN (393 g/L)	3.7 L/ha (1.48 L/acre) + 3.7–4.5 L/ha (1.5–1.8 L/acre)	· **Do NOT use on seed corn or sweet corn.** · Apply PRE or POST up to the 4 leaf stage of field corn. · See precautions for PROWL H20 alone, page 144, and BANVEL II, ORACLE or HAWKEYE alone, page 146.

TABLE 9–4. Herbicide Treatment Rates for Conventional Corn (Field, Seed and Sweet) (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Postemergence Grass Herbicides			
nicosulfuron (25 g/ha) + non-ionic surfactant (0.2% v/v) + liquid urea ammonium (5 L/ha)	ACCENT (75 DF) + non-ionic surfactant + liquid urea ammonium nitrate (UAN)	33 g/ha (13 g/acre) + 2 L/1,000 L + 5 L/ha (2 L/acre)	· **Do NOT** add liquid urea ammonium nitrate (UAN) when applying ACCENT to seed or sweet corn. · For use on all sweet corn varieties, however not all varieties have been tested. Contact the variety supplier for more information on the tolerance of a specific variety. · Adding UAN will give improved control of yellow foxtail in field corn. · Adapt oil concentrate (1% v/v), Merge or Sure-Mix (0.5% v/v) can be used in place of a non-ionic surfactant (field corn only). · Always add water soluble packages to clean water with the agitator running. Corn should be within the 1–8 leaf stage of growth. Apply ACCENT when annual grasses are in the 1–6-leaf stage and quackgrass is in the 3–6 leaf stage.
nicosulfuron/rimsulfuron (25 g/ha) + non-ionic surfactant (0.2% v/v)	ULTIM ((1:1) 75 DF) + non-ionic surfactant	33 g/ha (13 g/acre) + 2 L/1,000 L	· **Do NOT use on seed corn or sweet corn.** · Always add water soluble packages to clean water with the agitator running. Corn should be within the 1–6 leaf stage. Apply ULTIM when annual grasses are in the 1–6 leaf stage, and quackgrass is in the 3–6 leaf stage. · **ONLY** apply ULTIM when air temperatures in the 24 hours before and after application range between 5°C and 28°C.
Postemergence Broadleaf Herbicides and Tank-Mixes (for Broadleaf Weed Control)			
2,4-D (0.28–0.56 kg/ha)	2,4-D AMINE 600 (564 g/L)*	0.5–1 L/ha (0.2–0.4 L/acre)	· **Do NOT use on seed corn or sweet corn.** · Apply as an overall spray until corn is 15 cm high (leaf extended); thereafter, use drop nozzles. · Use the higher rate for larger weeds, heavy infestations are during unfavourable environmental conditions (e.g., dry weather). · See special notes on postemergence use of 2,4-D and related herbicides,page 135. · **Do NOT** add oil or surfactant. * Numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, page 30 for a complete list of available products.
atrazine (1.01–1.49 kg/ha) + oil (10–17 L/ha)	AATREX (480 g/L) + oil	2.1–3.1 L/ha (0.84–1.24 L/acre) + 10–17 L/ha (4–6.8 L/acre)	· For increased acretivity and extended period of acretivity, apply in an oil water emulsion of 10–17 L/ha (4–6.8 L/acre) of emulsifiable light mineral oil and 150–200 L/ha water (60–80 L/acre). Apply when most weeds have emerged. The low rate can be used successfully if subsequent cultivation is planned.
atrazine 1.1–1.49 kg/ha + bromoxynil/MCPA (0.56 kg/ha)	AATREX (480 g/L) + BUCTRIL M ((1:1) 560 g/L)	2.29–3.1 L/ha (0.96–1.24 L/acre) + 1 L/ha (0.4 L/acre)	· **Do NOT use on seed corn.** · Apply from the 4–6 leaf stage of corn but injury may occur if applied after the 6 leaf stage. · Controls a wider spectrum of broadleaf weeds than bromoxynil/MCPA alone. · **Do NOT** add oil or surfactant. · If harvesting sweet corn by hand, re-entry into the field is not permitted until 15 days after application.
	AATREX (480 g/L) + BADGE (450 g/L)	2.29–3.1 L/ha (0.96–1.24 L/acre) + 1.25 L/ha (0.5 L/acre)	
	AATREX (480 g/L) + MEXTROL (450 g/L)		
	AATREX (480 g/L) + LOGIC M (450 g/L)		

TABLE 9–4. Herbicide Treatment Rates for Conventional Corn (Field, Seed and Sweet) (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Postemergence Broadleaf Herbicides and Tank-Mixes (for Broadleaf Weed Control) (cont'd)			
atrazine (1.01–1.49 kg/ha) + dicamba (0.288 kg/ha)	AATREX (480 g/L) + BANVEL II (480 g/L)	2.1–3.1 L/ha (0.84–1.24 L/acre) + 0.6 L/ha (0.24 L/acre)	· **Do NOT use on seed corn.** · This treatment will provide good to excellent control of broadleaf weeds including those triazine resistant and velvetleaf. Use the higher rate for residual control. · See special notes for corn regarding dicamba applications, page 135 and precautions for BANVEL II, ORACLE or HAWKEYE alone POST, on this page.
	AATREX (480 g/L) + ORACLE (480 g/L)		
	AATREX (480 g/L) + HAWKEYE (480 g/L)		
atrazine (1.01–1.49 kg/ha) + bromoxynil (0.28 kg/ha)	AATREX (480 g/L) + PARDNER (280 g/L)	2.1–3.1 L/ha (0.84–1.24 L/acre) + 1–1.2 L/ha (0.4–0.48 L/acre)	· Apply from the 4–8 leaf stage of corn. A reduced rate of atrazine at 0.5 kg/ha (half the low rate) can be used to control weeds listed for PARDNER (or KORIL) alone plus ragweed up to the 8 leaf stage, velvetleaf and triazine susceptible red root pigweed up to 6 leaves. · **Do NOT** add oil or surfactant. · See precautions for bromoxynil, page 148 * Numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, page 30 for a complete list of available products.
	AATREX (480 g/L) + bromoxynil (240 g/L)*	2.1–3.1 L/ha (0.84–1.24 L/acre) + 1.2–1.4 L/ha (0.48–0.56 L/acre)	
	AATREX (480 g/L) + bromoxynil (480 g/L)*	2.1–3.1 L/ha (0.84 - 1.24 L/acre) + 0.6–0.7 L/ha (0.24–0.28 L/acre)	
dicamba (0.288–0.6 kg/ha)	BANVEL II (480 g/L)	0.6–1.25 L/ha (0.24–0.5 L/acre)	· **Do NOT use on seed corn or sweet corn.** · Apply from the spike to 5 leaf stage of corn. · Use drop pipes when corn is 20–50 cm tall. · See special notes on postemergence use of dicamba and related herbicides, page 135. · **Do NOT** use dicamba if temperature exceeds 25°C at the time of application, or if high humidity is expected, due to the possibility of dicamba volatilizing and injury to susceptible crops nearby. · **Do NOT** add oil or surfactant.
	ORACLE (480 g/L)		
	HAWKEYE (480 g/L)		
dicamba (0.14 kg/ha) + 2,4-D (0.4 kg/ha)	BANVEL II (480 g/L) + 2,4-D AMINE 600 (564 g/L)*	0.29 L/ha (0.12 L/acre) + 0.70 L/ha (0.29 L/acre)	· **Do NOT use on seed corn or sweet corn.** · Application can be made up to 10 cm standing corn. Use drop pipes when corn is 10–50 cm tall. · See special notes on postemergence use of dicamba, 2,4-D and related herbicides, page 135. · **Do NOT** add oil or surfactant. * Numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, page 30 for a complete list of available products.
	ORACLE (480 g/L) + 2,4-D AMINE 600 (564 g/L)*		
	HAWKEYE (480 g/L) + 2,4-D AMINE 600 (564 g/L)*		
bentazon (0.84–1.08 kg/ha)	BASAGRAN FORTÉ (480 g/L)	1.75–2.25 L/ha (0.7–0.9 L/acre)	· Top growth of nutsedge and Canada thistle are controlled and field bindweed may be suppressed by 2 applications of 1.75 L/ha (0.7 L/acre) (0.84 kg active/ha) applied 10 days apart. · Cool weather or drought may reduce control.

TABLE 9–4. Herbicide Treatment Rates for Conventional Corn (Field, Seed and Sweet) (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Postemergence Broadleaf Herbicides and Tank-Mixes (for Broadleaf Weed Control) (cont'd)			
bromoxynil/MCPA (0.558 kg/ha)	BUCTRIL M ((1:1) 560 g/L) BADGE (450 g/L) MEXTROL (450 g/L) LOGIC M (450 g/L)	1 L/ha (0.4 L/acre) + 1.25 L/ha (0.5 L/acre)	- **Do NOT use on seed corn.** - Apply from the 4–6 leaf stage of corn but injury may occur if applied after the 6 leaf stage. - Controls most annual broadleaf weeds up to the 4 leaf stage (lamb's-quarters and mustards to 8 leaf stage). - If harvesting sweet corn by hand, re-entry into the field is not permitted until 15 days after application.
flumetsulam (78.125 g/ha)	BROADSTRIKE RC (80%)	62.5 g/ha (25 g/acre)	- **Do NOT use on seed corn or sweet corn.** - Apply POST up to the 2 leaf stage of corn. - **Do NOT** use where the soil pH is greater than 7.8 or where the organic matter is less than 2%. - **Do NOT** apply to peat or muck soils or where the soil organic matter is greater than 5%. - **Do NOT** apply more then once a year.
mesotrione (0.1 kg/ha) + atrazine (0.28 kg/ha) + non-ionic surfactant (0.2% v/v)	CALLISTO (480 g/L) + AATREX (480 g/L) + non-ionic surfactant	0.21 L/ha (0.085 L/acre) + 0.58 L/ha (0.235 L/acre) + 2 L/1,000 L	- Apply from the 3–8 leaf stage of field corn. - Apply from the 3–6 leaf stage of seed or sweet corn. - **Do NOT** apply to Delmonte 2038 sweet corn. - **Do NOT** harvest sweet corn within 50 days of treatment. - Seed corn inbred and sweet corn varieties vary in their tolerance to CALLISTO, consult your seed supplier for more information. - Apply in 100–200 L/ha of water. - **Do NOT** apply to corn treated with an organophosphorous insecticide.
diflufenzopyr/dicamba (0.2 kg/ha) + non-ionic surfactant (0.25% v/v) + liquid urea ammonium (1.25% v/v)	DISTINCT (70 WG) + non-ionic surfactant + liquid urea ammonium nitrate (UAN)	0.285 kg/ha (0.115 kg/acre) + 2.5 L/1,000 L + 12.5 L/1,000 L	- **Do NOT use on seed corn or sweet corn.** - Apply to actively growing weeds when corn is in the 2–6 leaf stage. - Apply when temperatures above 4°C are predicted for the 24 hours before and after application.
2,4-DB (1.1–1.5 kg/ha)	EMBUTOX (625 g/L) CALIBER 625 (625 g/L) COBUTOX (625 g/L)	1.75–2.25 L/ha (0.7–0.9 L/acre)	- **Do NOT use on seed corn or sweet corn.** - See special notes on postemergence use of 2,4-DB and related hormone chemicals, page 135. - **Do NOT** add oil or surfactant.

TABLE 9–4. Herbicide Treatment Rates for Conventional Corn (Field, Seed and Sweet) (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Postemergence Broadleaf Herbicides and Tank-Mixes (for Broadleaf Weed Control) (cont'd)			
topramezone (12.5 g/ha) + atrazine (0.5 kg/ha)	IMPACT (336 g/L) + AATREX (480 g/L) + MERGE	37 mL/ha (15 mL/acre) + 1.04 L/ha (0.42 L/acre) + 5 L/1,000 L	· Apply to emerged grassy (up to 4 leaf) and broadleaf (up to 8 leaf) weeds. · Apply between the spike and 7 leaf stage of seed, sweet and field corn. · **For seed and sweet corn:** ASSIST + UAN must be used instead of MERGE at a rate of 12.5 L/1,000 L. The use of MERGE will increase the risk of crop injury to seed and sweet corn. · If using the adjuvant MERGE, **do NOT** add liquid ammonium nitrate (UAN).
	IMPACT (336 g/L) + AATREX (480 g/L) + ASSIST OIL + liquid urea ammonium nitrate (UAN)	37 mL/ha (15 mL/acre) + 1.04 L/ha (0.42 L/acre) + 12.5 L/1,000 L + 12.5 L/1,000 L	
	ARMEZON (336 g/L) + AATREX (480 g/L) + MERGE	37 mL/ha (15 mL/acre) + 1.04 L/ha (0.42 L/acre) + 5 L/1,000 L	
	ARMEZON (336 g/L) + AATREX (480 g/L) + ASSIST OIL + liquid urea ammonium nitrate (UAN)	37 mL/ha (15 mL/acre) + 1.04 L/ha (0.42 L/acre) + 12.5 L/1,000 L + 12.5 L/1,000 L	
dicamba/atrazine (1.48–1.8 kg/ha)	MARKSMAN (393 g/L)	3.7–4.5 L/ha (1.5–1.8 L/acre)	· **Do NOT use on seed corn or sweet corn.** · Application can be made up to 13 cm standing corn (5 leaf). Use the lower rate on coarse textured soils and the higher rate on medium to fine textured soils. · See special notes on postemergence use of dicamba and related herbicides, page 135.
MCPA (0.38–0.63 kg/ha)	MCPA AMINE (500 g/L)*	0.76–1.26 L/ha (0.3–0.5 L/acre)	· **Do NOT use on seed corn or sweet corn.** · Treat before the corn reaches 15 cm tall (leaf extended). · Use the lower rate for small, actively growing weeds and the higher rate for larger weeds or under adverse weather conditions. · Top growth control of fully developed horsetail (15–25 cm) can be achieved with 1 L/ha (0.4 L/acre) of product. * Numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, page 30 for a complete list of available products.
bromoxynil (0.28–0.34 kg/ha)	PARDNER (280 g/L)	1–1.2 L/ha (0.4–0.48 L/acre)	· Controls most annual broadleaf weeds, including triazine resistant species at the 1–4 leaf stage. · Some bromoxynil products are not registered for use on seed or sweet corn, refer to Chapter 4, Notes on Herbicides, page 40 and the product label for registered crop uses. * Numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, page 30 for a complete list of available products.
	bromoxynil (240 g/L)*	1.2–1.4 L/ha (0.48–0.56)	
	bromoxynil (480 g/L)*	0.6 – 0.7 L/ha (0.24 – 0.28 L/acre)	

TABLE 9–4. Herbicide Treatment Rates for Conventional Corn (Field, Seed and Sweet) (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more Information, see Chapter 4, Herbicides Used In Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Postemergence Broadleaf Herbicides and Tank-Mixes (for Broadleaf Weed Control) (cont'd)			
bromoxynil (0.28 kg/ha) + dicamba (0.144 kg/ha)	PARDNER (280 g/L) + BANVEL II (480 g/L)	1 L/ha (0.4 L/acre) + 0.3 L/ha (0.12 L/acre)	- **Do NOT use on seed corn or sweet corn.** - Apply when the corn is in the 4–6 leaf stage as an overall treatment and up to 50 cm standing corn, using drop pipes. - Controls most annual broadleaf weeds including triazine resistant lamb's-quarters, pigweed and ragweed up to the 6 leaf stage. - See special notes on postemergence use of dicamba and precautions for BANVEL II alone POST, page 146. * Numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, page 30 for a complete list of available products.
	bromoxynil (240 g/L)* + BANVEL II (480 g/L)	1.2 L/ha (0.48 L/acre) + 0.3 L/ha (0.12 L/acre)	
	bromoxynil (480 g/L)* + BANVEL II (480 g/L)	0.6 – 0.7 L/ha (0.24 – 0.28 L/acre) + 0.3 L/ha (0.12 L/acre)	
prosulfuron (10 g/ha) + non-ionic surfactant (0.2% v/v)	PEAK (75 WG) + non-ionic surfactant	13.3 g/ha (5.3 g/acre) + 2 L/1,000 L	- **Do NOT** apply to sweet corn. - Apply when the corn is in the 2–7 leaf stage. - Controls most annual broadleaf weeds including triazine resistant lamb's-quarters and pigweed up to the 6 leaf stage; cocklebur and velvetleaf up to the 6 leaf stage; and ragweed up to the 8 leaf stage. - **Do NOT** apply to corn treated with organophosphorus insecticides.
halosulfuron (34–67.5 g/ha) + non-ionic surfactant (0.25% v/v)	PERMIT (72.6% WG) + non-ionic surfactant	47–93 g/ha (19–38 g/acre) + 2.5 L/1,000 L	- Apply when the corn is in the spike–10 leaf stage. - For sweet corn, the maximum use rate is 70 g/ha (28 g/acre). - The 47 g/ha (19 g/acre) rate will control labelled broadleaf weeds and nutsedge that is shorter than 15 cm. - The 70–90 g/ha (28–38 g/acre) will control nutsedge that is 15–30 cm tall. - Permit can be applied up to twice per season, but not to exceed a total of 140 g/ha (56 g/acre) in sweet corn and 186 g/ha (76 g/acre) in seed or field corn.
MCPB/MCPA (15:1) (1.1–1.7 kg/ha)	TROPOTOX PLUS (400 g/L)	2.75–4.25 L/ha (1.1–1.7 L/acre)	- **Do NOT** use on seed corn or sweet corn. - Apply when corn is 30–60 cm high, using drop pipes. - See special notes on postemergence use of MCPB/MCPA and related herbicides, page 135. - **Do NOT** add oil or surfactant.
	CLOVITOX PLUS (400 g/L)		
	TOPSIDE (400 g/L)		
Postemergence Tank-Mixes (For Control of Grass and Broadleaf Weeds)			
nicosulfuron (25 g/ha) + dicamba (0.288 kg/ha) + non-ionic surfactant (0.2% v/v)	ACCENT (75 DF) + BANVEL II (480 g/L) + non-ionic surfactant	33 g/ha (13 g/acre) + 0.6 L/ha (0.24 L/acre) + 2 L/1,000 L	- **Do NOT** use on seed corn or sweet corn. - See precautions for ACCENT, page 145 and BANVEL II, page 146. - **Do NOT** apply to corn beyond the 6 leaf stage.

TABLE 9–4. Herbicide Treatment Rates for Conventional Corn (Field, Seed and Sweet) (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Postemergence Tank-Mixes (for Control of Grass and Broadleaf Weeds) (cont'd)			
nicosulfuron (25 g/ha) + mesotrione (0.1 kg/ha) + atrazine (0.28 kg/ha) + non-ionic surfactant (0.2% v/v)	ACCENT (75 DF) + CALLISTO (480 g/L) + AATREX LIQUID (480 g/L) + non-ionic surfactant	33 g/ha (13 g/acre) + 0.21 L/ha (0.085 L/acre) + 0.58 L/ha (0.235 L/acre) + 2 L/1,000 L	· Apply from the 3–8 leaf stage of corn. · Apply in 100–200 L/ha of water. · See precautions for ACCENT, page 145 and CALLISTO + AATREX LIQUID, page 147. · For use on all sweet corn varieties, however not all varieties have been tested. Contact the seed supplier for more information on the tolerance of a specific variety.
nicosulfuron (25 g/ha) + diflufenzopyr/dicamba (0.2 kg/ha) + non-ionic surfactant (0.2% v/v) + urea ammonium nitrate (5 L/ha)	ACCENT TOTAL (sold as a co-pack): ACCENT (75 DF) + DISTINCT (70 WG) + non-ionic surfactant + urea ammonium nitrate (UAN)	33 g/ha (13 g/acre) + 0.285 kg/ha (0.115 kg/acre) + 2.5 L/1,000 L + 5 L/ha (2 L/acre)	· **Do NOT** use on seed corn or sweet corn. · Apply to active growth stage of seedling broadleaf weeds (less than 5 cm tall). · Apply to annual grasses in the 1–6 leaf stage and to quackgrass in the 3–6 leaf stage (10–20 cm). · Apply when corn is in the 2–8 leaf stage. · ACCENT TOTAL is co-pack of ACCENT and DISTINCT. · See precautions for ACCENT, page 145 and DISTINCT, page 147.
nicosulfuron (25 g/ha) + dicamba/atrazine (1 kg/ha) + non-ionic surfactant (0.2% v/v)	ACCENT (75 DF) + MARKSMAN (393 g/L) + non-ionic surfactant	33 g/ha (13 g/acre) + 2.5 L/ha (1 L/acre) + 2 L/1,000 L	· **Do NOT use on seed or sweet corn.** · See precautions for ACCENT, page 145 and MARKSMAN, page 148. · **Do NOT** apply to corn beyond the 6 leaf stage.
nicosulfuron (25 g/ha) + bromoxynil (0.28 kg/ha) + non-ionic surfactant (0.2% v/v)	ACCENT (75 DF) + PARDNER (280 g/L) + non-ionic surfactant	33 g/ha (13 g/acre) + 1 L/ha (0.4 L/acre) + 2 L/1,000 L	· Use **ONLY** when the corn is between the 4 and 8 leaf stage. · See precautions for ACCENT, page 145 and PARDNER/bromoxynil, page 148. · For use on all sweet corn varieties, however not all varieties have been tested. Contact the seed supplier for more information on the tolerance of a specific variety. * Numerous products exist, refer to Table 4-1. Herbicides Used in Ontario, page 30 for a complete list of available products.
	ACCENT (75 DF) bromoxynil (240 g/L)* + non-ionic surfactant	33 g/ha (13 g/acre) + 1.2 L/ha (0.5 L/acre) + 2 L/1,000 L	
	ACCENT (75 DF) bromoxynil (480 g/L)* + non-ionic surfactant	33 g/ha (13 g/acre) + 0.6 L/ha (0.24 L/acre) + 2 L/1,000 L	
rimsulfuron/nicosulfuron (25 g/ha) + mesotrione (0.1 kg/ha) + non-ionic surfactant (0.2% v/v)	DESTRA (sold as a co-pack) DESTRA (75 DF) + CALLISTO (480 g/L) + non-ionic surfactant	33 g/ha (13 g/acre) + 0.21 L/ha (0.085 L/acre) + 2 L/1,000 L	· Always add water soluble packages to clean water with the agitator running. · Corn should be within the 1–6 leaf stage. · Apply Destra when annual grasses are in the 1–6 leaf stage, and quackgrass is in the 3–6 leaf stage. · **ONLY** apply Destra when air temperatures in the 24 hours before and after application range between 5°C and 28°C.

TABLE 9–4. Herbicide Treatment Rates for Conventional Corn (Field, Seed and Sweet) (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Postemergence Tank-Mixes (for Control of Grass and Broadleaf Weeds) (cont'd)			
topramezone (0.0125 kg/ha) + dimethenamid (1.0 kg/ha) + atrazine (0.5 kg/ha)	IMPACT (336 g/L)	37 mL/ha (15 mL/acre)	· **Do NOT** use on seed or sweet corn. · Apply POST up to 4 leaf grassy weeds and up to 8 leaf broadleaf weeds. · Apply between the spike and 3 leaf stage of corn. · The addition of FRONTIER MAX provides residual grassy weed control. · If using the adjuvant MERGE, **do NOT** add liquid ammonium nitrate (UAN).
	+ FRONTIER MAX (720 g/L)	+ 756 mL/ha (305 mL/acre)	
	+ AATREX (480 g/L)	+ 1.04 L/ha (0.42 L/acre)	
	+ MERGE	+ 2.5 L/1,000 L	
	IMPACT (336 g/L)	37 mL/ha (15 mL/acre)	
	+ FRONTIER MAX (720 g/L)	+ 756 mL/ha (305 mL/acre)	
	+ AATREX (480 g/L)	+ 1.04 L/ha (0.42 L/acre)	
	+ ASSIST OIL	+ 12.5 L/1,000 L	
	+ urea ammonium nitrate (UAN)	+ 12.5 L/1,000 L	
	ARMEZON (336g/L)	37 mL/ha (15 mL/acre)	
	+ FRONTIER MAX (720 g/L)	+ 756 mL/ha (305 mL/acre)	
	+ AATREX (480 g/L)	+ 1.04 L/ha (0.42 L/acre)	
	+ MERGE	+ 2.5 L/1,000 L	
	ARMEZON (336g/L)	37 mL/ha (15 mL/acre)	
	+ FRONTIER MAX (720 g/L)	+ 756 mL/ha (305 mL/acre)	
	+ AATREX (480 g/L)	+ 1.04 L/ha (0.42 L/acre)	
	+ ASSIST OIL	+ 12.5 L/1,000 L	
	+ urea ammonium nitrate (UAN)	+ 12.5 L/1,000 L	
foramsulfuron (35 g/ha) + atrazine (0.84–1.12 kg/ha) + liquid urea ammonium (2.5 L/ha)	OPTION 2.25 OD (22.5 g/L)	1.56 L/ha (0.63 L/acre)	· **Do NOT use on seed corn or sweet corn.** · Apply up to the 8 leaf stage of corn.
	+ AATREX (480 g/L)	+ 1.75–2.33 L/ha (0.7–0.93 L/acre)	
	+ urea ammonium nitrate (UAN)	+ 2.5 L/ha (1 L/acre)	
foramsulfuron (35 g/ha) + dicamba (0.144 kg/ha) + liquid urea ammonium (2.5 L/ha)	OPTION 2.25 OD (22.5 g/L)	1.56 L/ha (0.63 L/acre)	· **Do NOT use on seed corn or sweet corn.** · Apply up to the 8 leaf stage of corn.
	+ BANVEL II (480 g/L)	+ 0.3 L/ha (0.12 L/acre)	
	+ urea ammonium nitrate (UAN)	+ 2.5 L/ha (1 L/acre)	

TABLE 9–4. Herbicide Treatment Rates for Conventional Corn (Field, Seed and Sweet) (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Postemergence Tank-Mixes (for Control of Grass and Broadleaf Weeds) (cont'd)			
foramsulfuron (35 g/ha) + mesotrione (0.1 kg/ha) + atrazine (0.28 L/ha) + liquid urea ammonium (2.5 L/ha)	OPTION 2.25 OD (22.5 g/L) + CALLISTO (480 g/L) + AATREX (480 g/L) + urea ammonium nitrate (UAN)	1.56 L/ha (0.63 L/acre) + 0.21 L/ha (0.085 L/acre) + 0.58 L/ha (0.235 L/acre) + 2.5 L/ha (1 L/acre)	· **Do NOT use on seed corn or sweet corn.** · Apply up to the 8 leaf stage of corn. · Apply in 175 L/ha (70 L/acre) of water. · See precautions for CALLISTO + AATREX LIQUID, page 147.
foramsulfuron (35 g/ha) + diflufenzopyr/dicamba (0.2 kg/ha) + UAN (2.5 L/ha)	OPTION 2.25 OD (22.5 g/L) + DISTINCT (70 WG) + urea ammonium nitrate (UAN)	1.56 L/ha (0.63 L/acre) + 0.285 kg/ha (0.115 kg/acre) + 2.5 L/ha (1 L/acre)	· **Do NOT use on seed corn or sweet corn.** · Apply up to the 6 leaf stage of corn. · See precautions for DISTINCT, page 147.
foramsulfuron (35 g/ha) + dicamba/atrazine (1 kg/ha) + UAN (2.5 L/ha)	OPTION 2.25 OD (22.5 g/L) + MARKSMAN (393 g/L) + urea ammonium nitrate (UAN)	1.56 L/ha (0.63 L/acre) + 2.5 L/ha (1 L/acre) + 2.5 L/ha (1 L/acre)	· **Do NOT use on seed corn or sweet corn.** · Apply up to the 5 leaf stage of corn. · See precautions for MARKSMAN, page 148.
foramsulfuron (35 g/ha) + bromoxynil (0.14 kg/ha) + atrazine (0.5 kg/ha) + UAN (2.5 L/ha)	OPTION 2.25 OD (22.5 g/L) + PARDNER (280 g/L) + AATREX (480 g/L) + urea ammonium nitrate (UAN)	1.56 L/ha (0.63 L/acre) + 0.5 L/ha (0.2 L/acre) + 1.04 L/ha (0.42 L/acre) + 2.5 L/ha (1 L/acre)	· **Do NOT use on seed corn or sweet corn.** · Apply up to the 8 leaf stage of corn. · See precautions for PARDNER/bromoxynil, page 148.
	OPTION 2.25 OD (22.5 g/L) + bromoxynil (240 g/L)* + AATREX (480 g/L) + urea ammonium nitrate (UAN)	1.56 L/ha (0.63 L/acre) + 0.6 L/ha (0.24 L/acre) + 1.04 L/ha (0.42 L/acre) + 2.5 L/ha (1 L/acre)	* Numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, page 30 for a complete list of available products.
	OPTION 2.25 OD (22.5 g/L) + bromoxynil (480 g/L)* + AATREX (480 g/L) + urea ammonium nitrate (UAN)	1.56 L/ha (0.63 L/acre) + 0.3 L/ha (0.12 L/acre) + 1.04 L/ha (0.42 L/acre) + 2.5 L/ha (1 L/acre)	

TABLE 9–4. Herbicide Treatment Rates for Conventional Corn (Field, Seed and Sweet) (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Postemergence Tank-Mixes (For Control of Grass and Broadleaf Weeds) (cont'd)			
pendimethalin (1 kg/ha) + nicosulfuron (12.5 g/ha) + dicamba (300 g/ha) + non-ionic surfactant (0.2% v/v)	PROWL 400 (400 g/L) + ACCENT (75 DF) + BANVEL II (480 g/L) + non-ionic surfactant	2.5 L/ha (1 L/acre) + 16.7 g/ha (6.7 g/acre) + 0.625 L/ha (0.25 L/acre) + 2 L/1,000 L	· **Do NOT use on seed corn or sweet corn.** · Apply early postemergence from the spike to 4 leaf stage of corn. · See precautions for PROWL H20, page 144, ACCENT, page 145 and BANVEL II, ORACLE or HAWKEYE page 146.
	PROWL H20 (455 g/L) + ACCENT (75 DF) + BANVEL II (480 g/L) + non-ionic surfactant	2.2 L/ha (0.88 L/acre) + 16.7 g/ha (6.7 g/acre) + 0.625 L/ha (0.25 L/acre) + 2 L/1,000 L	
nicosulfuron/rimsulfuron (25 g/ha) + dicamba (0.288 kg/ha) + non-ionic surfactant (0.2% v/v)	ULTIM (75 DF) + BANVEL II (480 g/L) + non-ionic surfactant	33 g/ha (13 g/acre) + 0.6 L/ha (0.24 L/acre) + 2 L/1,000 L	· **Do NOT use on seed corn or sweet corn.** · Refer to product label(s) for weeds controlled, timing of application, and use precautions. If grass and broadleaf weed growth stages do not coincide, then a sequential application of ULTIM and BANVEL II, ORACLE or HAWKEYE is required. · See precautions for ULTIM alone, page 145 and BANVEL II, ORACLE or HAWKEYE alone, page 146.
	ULTIM (75 DF) + ORACLE (480 g/L) + non-ionic surfactant		
	ULTIM (75 DF) + HAWKEYE (480 g/L) + non-ionic surfactant		
nicosulfuron/rimsulfuron (25 g/ha) + mesotrione (0.1 kg/ha) + atrazine (0.28 kg/ha) + non-ionic surfactant (0.2% v/v)	ULTIM (75 DF) + CALLISTO (480 g/L) + AATREX (480 g/L) + non-ionic surfactant	33 g/ha (13 g/acre) + 0.21 L/ha (0.085 L/acre) + 0.58 L/ha (0.235 L/acre) + 2 L/1,000 L	· Apply from the 3–6 leaf stage of corn. · **Do NOT use on seed corn or sweet corn.** · Apply in 100–200 L/ha of water. · See precautions for ULTIM alone, page 145 and CALLISTO + AATREX LIQUID, page 147.
nicosulfuron/rimsulfuron (25 g/ha) + diflufenzopyr/dicamba (0.2 kg/ha) + non-ionic surfactant (0.25% v/v) + urea ammonium nitrate (12.5 L/1,000 L)	ULTIM TOTAL (sold as a co-pack): ULTIM (75 DF) + DISTINCT (70 WG) + non-ionic surfactant + urea ammonium nitrate (UAN)	33 g/ha (13 g/acre) + 0.285 kg/ha (0.115 kg/acre) + 2.5 L/1,000 L + 12.5 L/1,000 L	· **Do NOT use on seed corn or sweet corn.** · Apply to active growth stage of seedling broadleaf weeds (less than 5 cm tall). · Apply to annual grasses in the 1–6 leaf stage and to quackgrass in the 3–6 leaf stage. · ULTIM TOTAL is available **ONLY** as a co-pack of ULTIM + DISTINCT. · 1 bag of ULTIM TOTAL treats 10 acres. · See precautions for ULTIM alone, page 145 and DISTINCT alone, page 147.

TABLE 9–4. Herbicide Treatment Rates for Conventional Corn (Field, Seed and Sweet) (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Postemergence Tank-Mixes (For Control of Grass and Broadleaf Weeds) (cont'd)			
nicosulfuron/rimsulfuron (25 g/ha) + dicamba/atrazine (1.003 kg/ha) + non-ionic surfactant (0.2% v/v)	ULTIM (75 DF) + MARKSMAN (393 g/L) + non-ionic surfactant	33 g/ha (13 g/acre) + 2.5 L/ha (1 L/acre) + 2 L/1,000 L	· **Do NOT use on seed corn or sweet corn.** · Apply up to the 5 leaf stage of corn. · One solupak of ULTIM treats 1 ha (2.5 acre). If grass and broadleaf weed growth stages do not coincide, then a sequential application of ULTIM and MARKSMAN is required. · See precautions for ULTIM alone, page 145 and MARKSMAN alone, page 139.
nicosulfuron/rimsulfuron (25 g/ha) + bromoxynil (0.28 kg/ha) + non-ionic surfactant (0.2% v/v)	ULTIM ((1:1) 75 DF) + PARDNER (280 g/L) + non-ionic surfactant	33 g/ha (13 g/acre) + 1 L/ha (0.4 L/acre) + 2 L/1,000 L	· **Do NOT use on seed corn or sweet corn.** · Apply from the 3–6 leaf stage of corn for optimum control. · One solupak of ULTIM treats 1 ha (2.5 acre). Refer to product label(s) for weeds controlled, timing of application, and use precautions. If grass and broadleaf weed growth stages do not coincide, then a sequential application of ULTIM and PARDNER or BROMOTRIL, BROTEX or KORIL is required. · **Do NOT** apply ULTIM to corn treated with organophosphorous insecticides. * Numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, page 27 for a complete list of available products.
	ULTIM ((1:1) 75 DF) + bromoxynil (240 g/L) + non-ionic surfactant	33 g/ha (13 g/acre) + 1.2 L/ha (0.5 L/acre) + 2 L/1,000 L	
	ULTIM ((1:1) 75 DF) + bromoxynil (480 g/L) + non-ionic surfactant	33 g/ha (13 g/acre) + 0.6 L/ha (0.24 L/acre) + 2 L/1,000 L	
nicosulfuron/rimsulfuron (25 g/ha) + bromoxynil (0.14 kg/ha) + atrazine (0.5 kg/ha) + non-ionic surfactant (0.2% v/v)	ULTIM ((1:1) 75 DF) + PARDNER (280 g/L) + AATREX (480 g/L) + non-ionic surfactant	33 g/ha (13 g/acre) + 0.5 L/ha (0.2 L/acre) + 1.04 L/ha (0.42 L/acre) + 2 L/1,000 L	· **Do NOT use on seed corn or sweet corn.** · Apply from the 3–6 leaf stage of field corn. · This treatment provides improved control of larger velvetleaf (up to 6 leaf stage) and common ragweed (up to 8 leaf stage). If grass and broadleaf weed growth stages do not coincide, then a sequential application of ULTIM and PARDNER, BROMOTRIL, BROTEX or KORIL plus atrazine is required. · **Note:** some hybrids have shown sensitivity to ULTIM. Consult the seed supplier. · See precautions for ULTIM alone, page 145, PARDNER/bromoxynil alone, page 148 and AATREX alone, page 139. * Numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, page 80 for a complete list of available products.
	ULTIM ((1:1) 75 DF) + bromoxynil (240 g/L)* + AATREX (480 g/L) + non-ionic surfactant	33 g/ha (13 g/acre) + 0.6 L/ha (0.24 L/acre) + 1.04 L/ha (0.42 L/acre) + 2 L/1,000 L	
	ULTIM ((1:1) 75 DF) + bromoxynil (480 g/L)* + AATREX (480 g/L) + non-ionic surfactant	33 g/ha (13 g/acre) + 0.3 L/ha (0.12 L/acre) + 1.04 L/ha (0.42 L/acre) + 2 L/1,000 L	

Glyphosate Tolerant ("Roundup Ready") Corn

Weed Management Strategies for Glyphosate Tolerant Corn

There are four main strategies that one can use to manage weeds in glyphosate tolerant corn:

- A single application of glyphosate.
- Glyphosate tank-mixed with a residual herbicide.
- Two in-crop applications of glyphosate.
- A preemergence application with a residual herbicide followed with an in crop application of glyphosate.

Public research trials evaluated the performance of these four strategies at 11 locations over 2 growing seasons. Yield data from these trials are presented in Table 9–5. *Corn Yield From Different Weed Management Strategies in Glyphosate Tolerant Corn,* on this page, as a percentage of the top yielding treatment. In general, all four strategies can provide maximum yields in any given field provided it offers excellent weed control from the 3–8 leaf stage of corn.

TABLE 9–5. Corn Yield From Different Weed Management Strategies in Glyphosate Tolerant Corn

Strategy	Pros	Cons	Yield (%)
Two Pass Glyphosate glyphosate applied at the 3–4 leaf stage of corn and again at the 7–8 leaf stage of corn	· Typically provides the best weed control and corn yields. · Better perennial weed control.	· More expensive. · Increases selection pressure of glyphosate and chance of selecting herbicide resistant weed populations.	100
PRE/POST residual herbicide applied PRE followed by glyphosate applied at the 7–8 leaf stage of corn	· Typically provides the best weed control and corn yields. · Multiple herbicide modes of action to manage resistant weed populations. · Better perennial weed control.	· More expensive.	99
One Pass Tank-Mix with Residual Herbicide glyphosate + residual herbicide applied at the 3–4 leaf stage of corn	· Only one application. · Multiple herbicide modes of action to manage resistant weed populations.	· Timing too early to control many perennial weeds. · Reduced weed control when tank-mix partner does not provide residual control of weed spectrum in the field.	97
One Pass Glyphosate (Early) glyphosate applied at the 3–4 leaf stage of corn	· Only one application.	· Season long weed control not always possible. · Weeds emerging after application can significantly reduce yield.	96
One Pass Glyphosate (Late) glyphosate applied at the 7–8 leaf stage of corn	· Not recommended.	· Not recommended.	90

Yield data collected from 11 replicated trials during the 2007 and 2008 growing seasons.
Source: Dr. P.H. Sikkema (Ridgetown Campus, University of Guelph) and Dr. R. Nurse (AAFC, Harrow).

NOTES: Weed control ratings are given as 0–9 where 0 indicates no control, and 9 indicates 90%–100% control under ideal conditions. Ratings are subjective values based on best available information and given general comparisons based on use as described in this guide. Under unfavourable conditions (e.g., too dry, too wet, too cold or poor application) the herbicides may not be as effective as indicated. Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used. Always refer to the product label for more information on registered weed species, product uses and precautions.

TABLE 9–6. Glyphosate Tolerant ("Roundup Ready") Corn Herbicide Weed Control Ratings

LEGEND: Numbers (0–9) = weed control ratings
* = sold as a co-pack under this trade name
R = populations resistant to this herbicide exist in Ontario and won't be adequately controlled if present
Crop tolerance ratings: E = Excellent, G = Good, F = Fair, P = Poor
– = insufficient information available to make a rating

		Annual Grasses									**Annual Broadleaves**												**Perennials**							
Trade Name	**Weed Stage**	**barnyard grass**	**smooth crabgrass**	**large crabgrass**	**fall panicum**	**foxtail, giant**	**foxtail, green**	**foxtail, yellow**	**witchgrass**	**proso millet**	**buckwheat, wild**	**cocklebur**	**corn spurry**	**fleabane, Canada**	**lady's thumb**	**lamb's-quarters**	**mustards**	**nightshades**	**pigweeds**	**ragweed, common**	**ragweed, giant**	**velvetleaf**	**bindweed, field**	**horsetail**	**milkweed**	**nutsedge**	**quackgrass**	**sow-thistle**	**thistle, Canada**	**Crop Tolerance**
Preemergence Herbicides with Limited Residual Weed Control – May Require a Postemergence Glyphosate Application (Glyphosate Tolerant Hybrids Only)																														
BATTALION*	un-emerged	9	8	8	9	8	8	8	9	9^1	9	–	8	8	8	9	8	8	9	9	7	8	–	–	–	–	7^1	7^1	–	G
CONVERGE XT*	un-emerged	9	9	9	9	9	7	9	9	9	9	7	–	6	9	9	9	9	9	9	6	9	–	0	0	0	0	0	0	G
ENGARDE*	un-emerged	9	8	8	9	9	9	7	9	9	9	5	8	–	9	9	9	9	9	8	–	9	–	–	–	8^1	7^1	–	–	E
FOCUS*	un-emerged	9	9	8	–	9	9	9	–	–	8	–	–	–	–	8	9	9	9	7	–	6	–	–	–	–	–	–	–	E
INTEGRITY	un-emerged	9	8	7	–	8	8	8	9	4	9	8	–	9	9	9	9	7	9	9	5	9	0	5	0	6	0	0	0	E
LUMAX EZ	un-emerged	9	9	9	8^1	8	8	8	9	4	8	8	–	8	9	9	9	9	9	8	8^4	9	–	–	–	–	–	–	–	E
PRIMEXTRA II MAGNUM	un-emerged	9	8	8	8	8	8	8	9	2	9	7	9	6	9	9^R	9	9	9^R	7^R	–	5	0	0	0	3	0	0	0	E
PROWL H2O + AATREX	un-emerged	9	–	–	–	–	8	8	–	–	9	7	9	5	9	9^R	9	9	9^R	8^R	6	6	2	0	0	0	0	2	2	E
PROWL H2O + MARKSMAN	un-emerged	9	–	–	–	–	8	8	–	–	9	9	9	9	9	9	9	9	9	8	7	8	8^1	0	0	0	0	8^1	8^1	E
One Pass Postemergence Non-Residual Herbicides for Glyphosate Tolerant Hybrids Only																														
glyphosate[2,3]	emerged weeds	9	9	9	9	9	9	9	9	9	8	9	8	9^R	8	9	9	9	9	9	8^R	9	7	–	8	8^4	9	8	9	E^3

[1] Weed must be emerged to achieve this level of control.

[2] Various formulations available, see Table 9–8. Glyphosate Product Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant ("Roundup Ready") Corn, page 160. See label for specific uses and rates.

[3] For use on ROUNDUP READY corn (glyphosate tolerant) only.

[4] Glyphosate must be applied at a rate of 1.8 kg ai/ha in order to achieve this level of control, refer to Table 9–8. *Glyphosate Product Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant ("Roundup Ready") Corn*, page 160 for product rate equivalents.

TABLE 9–6. Glyphosate Tolerant ("Roundup Ready") Corn Herbicide Weed Control Ratings (cont'd)

LEGEND: Numbers (0–9) = weed control ratings
Crop tolerance ratings: E = Excellent, G = Good, F = Fair, P = Poor
– = insufficient information available to make a rating
* = sold as a co-pack under this trade name
R = populations resistant to this herbicide exist in Ontario and won't be adequately controlled if present

		Annual Grasses									Annual Broadleaves												Perennials							
Trade Name	**Weed Stage**	**barnyard grass**	**smooth crabgrass**	**large crabgrass**	**fall panicum**	**foxtail, giant**	**foxtail, green**	**foxtail, yellow**	**witchgrass**	**proso millet**	**buckwheat, wild**	**cocklebur**	**corn spurry**	**fleabane, Canada**	**lady's thumb**	**lamb's-quarters**	**mustards**	**nightshades**	**pigweeds**	**ragweed, common**	**ragweed, giant**	**velvetleaf**	**bindweed, field**	**horsetail**	**milkweed**	**nutsedge**	**quackgrass**	**sow-thistle**	**thistle, Canada**	**Crop Tolerance**
One Pass Postemergence Tank-Mixes with Residual Weed Control for Glyphosate Tolerant Hybrids Only																														
CALLISTO GT[3]	emerged weeds	9	9	9	9	9	9	9	9	9	8	9	8	8	8	9	9	9	9	9	8^R	9	7	–	8	8[4]	9	8	9	G[3]
	residual weed control	–	–	–	–	–	–	–	–	–	9	6	9	8	9	9	9	9	9	7	5	9	2	0	0	^{0}	0	0	0	
DESTRA* + glyphosate[2,3]	emerged weeds	9	9	9	9	9	9	9	9	9	8	9	8	9^R	8	9	9	9	9	9	8^R	9	7	–	8	8[4]	9	8	9	G[3]
	residual weed control	–	–	–	8	8	8	8	8	9	9	6	9	8	9	9	9	9	9	7	6	9	2	0	0	^{0}	0	0	0	
GALAXY 2[3]	emerged weeds	9	9	9	9	9	9	9	9	9	8	9	8	9^R	8	9	9	9	9	9	8^R	9	7	–	8	8[4]	9	8	9	E[3]
	residual weed control	–	–	9	8	8	8	8	8	9	8	–	–	–	8	7	–	7	8	7	–	7	2	0	0	0	7	0	0	E[3]
glyphosate[2,3] + AATREX	emerged weeds	9	9	9	9	9	9	9	9	9	8	9	8	9^R	8	9	9	9	9	9	8^R	9	7	–	8	8[4]	9	8	9	E[3]
	residual weed control	2	2	2	2	2	2	2	2	2	9	7	9	5	9	9^R	9	9	9^R	9^R	6	5	2	0	0	0	0	0	0	E[3]
glyphosate[2,3] + CALLISTO + AATREX	emerged weeds	9	9	9	9	9	9	9	9	9	8	9	8	8	9	9	9	9	9	9	8^R	9	7	–	8	8[4]	9	8	9	E[3]
	residual weed control	2	0	2	0	2	2	2	2	2	9	6	9	8	9	9	9	9	9	9	6	9	2	0	0	0	0	0	0	E[3]
glyphosate[2,3] + CONVERGE XT*	emerged weeds	9	9	9	9	9	9	9	9	9	9	9	8	9^R	9	9	9	9	9	9	8^R	9	7	–	8	8[4]	9	8	9	E[3]
	residual weed control	9	–	–	9	–	9	9	9	–	9	–	–	6	9	9	9	–	9	9	6	9	–	0	0	0	0	0	0	E[3]
glyphosate[2,3] + ENGARDE*	emerged weeds	9	8	8	9	9	9	7	9	9	9	9	8	9^R	9	9	9	9	9	8	8^R	9	–	–	–	8	9	–	–	E
	residual weed control	9	8	8	9	9	9	7	9	9	9	5	8	0	9	9	9	9	9	8	–	9	–	–	–	7	–	–	–	E
glyphosate[2,3] + (IMPACT **or** ARMEZON) + AATREX	emerged weeds	9	9	9	9	9	9	9	9	9	8	9	8	9^R	8	9	9	9	9	9	9	9	7	–	8	8[4]	9	8	9	E[3]
	residual weed control	6	0	6	0	6	6	0	0	0	8	7	9	6	9	9	9	9	9	9	6	6	0	0	0	0	0	0	0	E[3]
glyphosate[2,3] + MARKSMAN	emerged weeds	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	7	–	8	8[4]	9	8	9	E[3]
	residual weed control	2	2	2	2	2	2	2	2	2	9	7	9	–	9	9	9	9	9	9	7	8	2	0	0	0	2	2	2	E[3]

[1] Weed must be emerged to achieve this level of control.

[2] Various formulations available, see Table 9–8. Glyphosate Product Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant ("Roundup Ready") Corn, page 160. See label for specific uses and rates.

[3] For use on ROUNDUP READY corn (glyphosate tolerant) only.

[4] Glyphosate must be applied at a rate of 1.8 kg ai/ha in order to achieve this level of control, refer to Table 9–8. *Glyphosate Product Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant ("Roundup Ready") Corn*, page 160 for product rate equivalents.

TABLE 9–6. Glyphosate Tolerant ("Roundup Ready") Corn Herbicide Weed Control Ratings (cont'd)

LEGEND: Numbers (0–9) = weed control ratings
* = sold as a co-pack under this trade name
R = populations resistant to this herbicide exist in Ontario and won't be adequately controlled if present

Crop tolerance ratings: E = Excellent, G = Good, F = Fair, P = Poor

– = insufficient information available to make a rating

Trade Name	Weed Stage	Annual Grasses									Annual Broadleaves												Perennials							
		barnyard grass	smooth crabgrass	large crabgrass	fall panicum	foxtail, giant	foxtail, green	foxtail, yellow	witchgrass	proso millet	buckwheat, wild	cocklebur	corn spurry	fleabane, Canada	lady's thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed, common	ragweed, giant	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada	Crop Tolerance
One Pass Postemergence Tank-Mixes with Residual Weed Control for Glyphosate Tolerant Hybrids Only (cont'd)																														
glyphosate[2,3] + PRIMEXTRA II MAGNUM	emerged weeds	9	9	9	9	9	9	9	9	9	9	9	9	9^R	9	9	9	9	9	9	8^R	9	7	–	8	8[4]	9	8	9	E[3]
	residual weed control	9	8	8	8	8	8	8	9	2	9	7	9	6	9	9	9	9	9	9	–	5	0	0	0	3	0	0	0	E[3]
HALEX GT[3] + AATREX	emerged weeds	9	9	9	9	9	9	9	9	9	9	9	9	8	9	9	9	9	9	9	7	9	7	–	8	8[4]	9	8	9	E[3]
	residual weed control	9	9	9	9	9	9	9	9	4	9	8	–	8	9	9	9	9	9	8	6	9	2	0	0	3	0	0	0	E[3]
LUMAX EZ + glyphosate (360 g/L)	emerged weeds	9	9	9	9	9	9	9	9	9	8	9	8	8	8	9	9	9	9	9	8^R	9	7	–	8	8[4]	9	8	9	G3
	residual weed control	9	9	9	8[1]	8	8	8	9	4	8	8	8	8	8	9	9	9	9	7	5	9	7	–	8	8[4]	9	8	9	
PERMIT + glyphosate[2,3]	emerged weeds	9	9	9	9	9	9	9	9	9	9	9	9	9^R	9	9	9	9	9	9	8^R	9	7	–	8	8	9	8	9	E
	residual weed control	9	9	9	9	9	9	9	9	4	–	8	–	8^R	8	8^R	8	–	8^R	8^R	8^R	8	–	–	–	6	0	–	–	E
VIOS G3 + glyphosate[2,3]	emerged weeds	9	9	9	9	9	9	9	9	9	9	9	9	9^R	9	9	9	9	9	9	8^R	9	7	–	8	8[4]	9	8	9	E[3]
	residual weed control	9	8	8	9	9	9	9	9	7	9	–	–	4	9	9	9	9	9	9	–	8	–	–	–	0	–	0	–	E[3]
Two Pass Treatments for Glyphosate Tolerant Hybrids Only																														
glyphosate[2,3] (2–3 leaf); glyphosate[2,3] (7–8 leaf)	all stages	9	9	9	9	9	9	9	9	9	8	9	8	8^R	8	9	9	9	9	9	8^R	9	8	–	9	8[4]	9	9	9	E[3]

[1] Weed must be emerged to achieve this level of control.

[2] Various formulations available, see Table 9–8. Glyphosate Product Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant ("Roundup Ready") Corn, page 160. See label for specific uses and rates.

[3] For use on ROUNDUP READY corn (glyphosate tolerant) only.

[4] Glyphosate must be applied at a rate of 1.8 kg ai/ha in order to achieve this level of control, refer to Table 9–8. *Glyphosate Product Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant ("Roundup Ready") Corn*, page 160 for product rate equivalents.

NOTES: Weed control ratings are given as 0–9 where 0 indicates no control, and 9 indicates 90–100% control under ideal conditions. Ratings are subjective values based on best available information and given general comparisons based on use as described in this guide. Under unfavourable conditions (e.g., too dry, too wet, too cold or poor application) the herbicides may not be as effective as indicated. Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used. Always refer to the product label for more information on registered weed species, product uses and precautions.

TABLE 9–7. Additional Weed Control Ratings for Glyphosate Tolerant ("Roundup Ready") Corn

LEGEND: Numbers (0–9) = weed control ratings – = insufficient information available to make a rating

	Volunteer Crops		**Grasses**			**Annual and Biennial Broadleaves**												**Perennials**			
Trade Name	**adzuki beans (volunteer)**	**wheat (volunteer)**	**sandbur**	**stink grass**	**tufted love grass**	**bur-cucumber**	**biennial wormwood**	**chickweed, common**	**flower of an hour**	**lettuce, prickly**	**nipplewort**	**spreading atriplex**	**swamp smartweed**	**three seeded mercury**	**waterhemp**	**wild carrot**	**wood-sorrel (oxalis)**	**horsenettle**	**red top**	**vetch, tufted**	**wirestem muhly**
Postemergence Grass and Broadleaf Herbicides (Glyphosate Tolerant Hybrids Only)																					
glyphosate[1]	9	9	9	–	–	8	8	9	9	9	–	7/8	5	8	9	–	–	8[2]	–	5	9
glyphosate[1] + AATREX	9	9	9	–	–	8	8	9	9	9	9	7/8	5	9	9	2	9	8[2]	–	5	9
glyphosate[1] + CALLISTO + AATREX	9	9	9	–	–	8	8	9	9	9	6	5	5	8	9	8	–	8[2]	0	6	9
glyphosate[1] + MARKSMAN	9	9	9	–	–	8	9	9	9	9	9	7/8	5	9	9	9	–	8[2]	–	8	9

[1] For use on "Roundup Ready" corn (glyphosate tolerant) only. See Table 9–8. *Glyphosate Product Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant ("Roundup Ready") Corn*, page 160 for a list of registered products.

[2] Glyphosate must be applied at a rate of 1.8 kg ai/ha in order to achieve this level of control, refer to Table 9–8. *Glyphosate Product Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant ("Roundup Ready") Corn*, page 160 for product rate equivalents.

TABLE 9–8. Glyphosate Product Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant ("Roundup Ready") Corn

LEGEND: a.i. = active ingreditent ✓ = product contains this salt type — = not in product

	PRODUCT RATE					SALT TYPE		
Glyphosate Products	**0.9 kg/ha a.i.**	**1.35 kg/ha a.i.**	**1.8 kg/ha a.i.**	**Manufacturer**	**Rainfast**	**Dimethylamine**	**Isopropylamine**	**Potassium**
CREDIT XTREME (540 g/L)	0.67 L/acre	1 L/acre	1.34 L/acre	NUFARM	not specified	—	✓	—
FACTOR 540 (540 g/L)	0.67 L/acre	1 L/acre	1.34 L/acre	IPCO	1 hour	—	—	—
GLYFOS (360 g/L)	1 L/acre	1.5 L/acre	2 L/acre	CHEMINOVA	not specified	—	✓	—
MATRIX (480 g/L)	0.75 L/acre	1.13 L/acre	1.5 L/acre	IPCO	not specified	✓	—	—
MAVERICK III (480 g/L)	0.75 L/acre	1.13 L/acre	1.5 L/acre	DOW AGROSCIENCE	not specified	✓	—	—
POLARIS (360 g/L)	1 L/acre	1.5 L/acre	2 L/acre	DUPONT	not specified	—	✓	—
ROUNDUP ULTRA2 (540 g/L)	0.67 L/acre	1 L/acre	1.34 L/acre	MONSANTO	1 hour	—	—	✓
ROUNDUP WEATHERMAX (540 g/L)	0.67 L/acre	1 L/acre	1.34 L/acre	MONSANTO	1 hour	—	—	✓
SHARPSHOOTER PLUS (360 g/L)	1 L/acre	1.5 L/acre	2 L/acre	UAP	not specified	—	✓	—
TOUCHDOWN TOTAL (500 g/L)	0.72 L/acre	1.1 L/acre	1.44 L/acre	SYNGENTA	not specified	—	—	✓
TRAXION (500 g/L)	0.72 L/acre	1.1 L/acre	1.44 L/acre	SYNGENTA	not specified	—	—	✓
VANTAGE PLUS MAX II(480 g/L)	0.75 L/acre	1.13 L/acre	1.5 L/acre	DOW AGROSCIENCE	not specified	✓	—	—

TABLE 9–9. Herbicide Treatment Rates for Glyphosate Tolerant ("Roundup Ready") Corn

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Preplant Burndown and Residual Control			
· Non-selective herbicides such as glyphosate and GRAMAXONE are used to control emerged weeds prior to no-till planting. Tank-mixing of a residual herbicide with glyphosate or GRAMAXONE can be used to improve application efficiency with a "one pass" weed management program. · Refer also to Chapter 6, Preplant & Postharvest Weed Control, page 91 for preplant application rates for glyphosate and GRAMAXONE. · It is also important to note that when targeting perennial weeds, the addition of a triazine-based herbicide (e.g., AATREX, CONVERGE 480, MARKSMAN, PRIMEXTRA II MAGNUM) will reduce the level of activity achieved with glyphosate. Increasing the rate of glyphosate should overcome this antagonism.			
Preemergence Herbicides with Limited Residual Weed Control – May Require a Postemergence Glyphosate Application (Glyphosate Tolerant Hybrids Only)			
rimsulfuron (12.5 g/ha) + s-metolachlor/benoxacor (573 g/ha) + dicamba (300 g/ha)	BATTALION (sold as a co-pack): ELIM EP (25 DF) + DUAL II MAGNUM (915 g/L) + BANVEL II (480 g/L)	 50 g/ha (20 g/acre) + 0.625 L/ha (0.25 L/acre) + 0.625 L/ha (0.25 L/acre)	· Use **ONLY** with pedigreed (certified) corn seed designated as glyphosate tolerant or "Roundup Ready" corn. · See precautions for BATTALION, page 140. · A postemergence application of glyphosate applied at the 7–8 leaf stage of corn may be necessary for the control of perennial weeds or weed escapes.
isoxaflutole (52.5 g/ha) + atrazine (532 g/ha)	CONVERGE XT (sold as a co-pack): CONVERGE FLEXX (240 g/L) + CONVERGE 480 (480 g/L)	 220 mL/ha (89 mL/acre) + 1.1 L/ha (0.44 L/acre)	· Use **ONLY** with pedigreed (certified) corn seed designated as glyphosate tolerant or "Roundup Ready" corn. · Use for early season weed control through the critical crop establishment phase. · Use in a planned weed management program with a post-emergent glyphosate application. · See precautions for CONVERGE XT, page 141.
rimsulfuron (15 g/ha) + mesotrione (144 g/ha)	ENGARDE (sold as a co-pack): ENGARDE 25SG + ENGARDE 480SC	 60 g/ha (24 g/acre) + 300 mL/ha (120 mL/acre)	· Apply PRE or Early POST up to the 2 leaf stage of corn. · Engarde can be applied with 28% UAN as a carrier **(PRE only)**. · Can be tank-mixed with glyphosate for emerged annual and perennial weeds. See Chapter 6, Preplant & Postharvest Weed Control, page 91 for more information.
carfentrazone-ethyl (8.76 g/ha) + pyroxasulfone (100 g/ha)	FOCUS (sold as a co-pack): AIM EC (240 g/L) + PYROXASULFONE (85 WG)	 60 mL/ha (24 mL/acre) + 118 g/ha (48 g/acre)	· Apply PP or PRE. · **Do NOT** use on peat or muck soils and soils with 7% or more organic matter content. · Moisture is necessary to activate the active ingredient pyroxasulfone in soil for weed control. · The AIM EC component will only control emerged broadleaf weeds at application.
saflufenacil/ dimethenamid-P (488 g/ha)	INTEGRITY (668 g/L)	0.73 L/ha (0.292 L/acre)	· Use **ONLY** with pedigreed (certified) corn seed designated as glyphosate tolerant or "Roundup Ready" corn. · A postemergence application of glyphosate applied at the 7–8 leaf stage of corn may be necessary for the control of perennial weeds or weed escapes. · See precautions for INTEGRITY, page 138.

TABLE 9–9. Herbicide Treatment Rates for Glyphosate Tolerant ("Roundup Ready") Corn (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Preemergence Herbicides with Limited Residual Weed Control – May Require a Postemergence Glyphosate Application (Glyphosate Tolerant Hybrids Only) (cont'd)			
s-metolachlor/benoxacor/ atrazine/mesotrione (1,475 g/ha)	LUMAX EZ (298 g/L, 112 g/L, 30 g/L)	3.35 L/ha (1.36 L/acre)	· Apply surface pre-plant up to 7 days prior to planting, PRE or Early POST up to the 2 leaf stage of field corn. · Grassy weeds beyond the 2 leaf stage will not be controlled. · **Do NOT** apply to corn treated with an organophosphorous insecticide. · This rate of LUMAX EZ will provide suppression through the critical crop establishment phase and is to be used in a planned weed management program with a postemergent herbicide treatment.
s-metolachlor/benoxacor/ atrazine (1.8 kg/ha)	PRIMEXTRA II MAGNUM ((1:0.8) 720 g/L)	2.5 L/ha (1 L/acre)	· Use **ONLY** with pedigreed (certified) corn seed designated as glyphosate tolerant or "Roundup Ready" corn. · This reduced rate of PRIMEXTRA II MAGNUM (1 L/acre) provides suppression of labeled weeds and is part of a planned weed management program that includes a follow-up postemergence treatment of glyphosate.
pendimethalin (1 kg/ha) + atrazine (1 kg/ha)	PROWL H20 (455 g/L) + AATREX (480 g/L)	2.2 L/ha (0.89 L/acre) + 2.1 L/ha (0.83 L/acre)	· Use **ONLY** with pedigreed (certified) corn seed designated as glyphosate tolerant or "Roundup Ready" corn. · A postemergence application of glyphosate applied at the 7–8 leaf stage of corn may be necessary for the control of perennial weeds or weed escapes. · See precautions for PROWL H20 alone, page 144 and AATREX alone, page 139.
pendimethalin (1 kg/ha) + dicamba/atrazine (1 kg/ha)	PROWL H20 (455 g/L) + MARKSMAN (393 g/L)	2.2 L/ha (0.89 L/acre) + 2.5 L/ha (1 L/acre)	· Use **ONLY** with pedigreed (certified) corn seed designated as glyphosate tolerant or "Roundup Ready" corn. · A postemergence application of glyphosate applied at the 7–8 leaf stage of corn may be necessary for the control of perennial weeds or weed escapes. · See precautions for PROWL H20 alone, page 144 and MARKSMAN alone, page 139.
One Pass Postemergence Non-Residual Herbicides for Glyphosate Tolerant Hybrids Only			
glyphosate (0.9–1.8 kg/ha)	glyphosate (360 g/L)*	2.5–5 L/ha (1–2 L/acre)	· Use **ONLY** with pedigreed (certified) corn seed designated as glyphosate tolerant or "Roundup Ready" corn. See Table 9–8. Glyphosate Product Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant ("Roundup Ready") Corn, page 160, for a list of registered glyphosate products. · Apply up to and including the 8 leaf stage of corn. · Applications should be timed to keep the corn crop weed-free from the 3–8 leaf stage of corn. *Numerous products exist. Refer to Table 9–8. Glyphosate Product Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant ("Roundup Ready") Corn, page 160 for a complete list.
	other glyphosate products	See Table 9–8.	

TABLE 9–9. Herbicide Treatment Rates for Glyphosate Tolerant ("Roundup Ready") Corn (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
One Pass Postemergence Tank-Mixes with Residual Control for Use in Glyphosate Tolerant Corn Only			
glyphosate (455 g/L) (1050 g/ha) + mesotrione (45.5 g/L) (105 g/ha) + nonionic surfactant (0.2% v/v)	CALLISTO GT + non-ionic surfactant	2.25 L/ha (0.9 L/acre) + 2 L/1,000 L	• CALLISTO GT can be applied up to and including the 8-leaf stage of GT corn. • Add a non-ionic spray surfactant, such as AGRAL 90, at a rate of 0.2% v/v. • In addition to broad-spectrum burn-down of emerged weeds, CALLISTO GT will provide residual control of Eastern Black Nightshade, redroot pigweed, velvetleaf and suppression of common ragweed.
rimsulfuron/nicosulfuron (25 g/ha) + mesotrione (0.1 kg/ha) + glyphosate (900 g/ha)	DESTRA (sold as a co-pack) DESTRA (75 DF) + CALLISTO (480 g/L) + glyphosate (360 g/L)*	33 g/ha (13 g/acre) + 0.21 L/ha (0.085 L/acre) + 2.5 L/ha (1 L/acre)	• Use **ONLY** with pedigreed (certified) corn seed designated as glyphosate tolerant or "Roundup Ready" corn. • Apply from 2 leaf to the 6 leaf stage of corn. • Use on corn with corn heat units (CHU) greater than 2,500. • Water Volume: 140–190 L/ha (56 – 76 L/acre). • Provides residual control of fall panicum, green foxtail, lamb's-quarters and pigweed spp. *Numerous products exist. Refer to Table 9–8. Glyphosate Product Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant ("Roundup Ready") Corn, page 160 for a complete list.
nicosulfuron/rimsulfuron (25 g/ha) + glyphosate (0.9 kg/ha)	GALAXY 2 (sold as a co-pack): ULTIM (75 DF) + POLARIS (360 g/L)	33 g/ha (13 g/acre) + 2.5 L/ha (1 L/acre)	• Use **ONLY** with pedigreed (certified) corn seed designated as glyphosate tolerant or "Roundup Ready" corn. • Apply from the spike to the 6 leaf stage of corn. • Use on corn with corn heat units (CHU) greater than 2,500. • **Water Volume:** 140–190 L/ha. • Provides residual control of fall panicum, green foxtail, lamb's-quarters and pigweed spp. • Tank-mix with CALLISTO for improved residual broadleaf weed control.
glyphosate (0.9 kg/ha) + atrazine (0.75–1.0 kg/ha)	glyphosate (360 g/L)* + AATREX (480 g/L)	2.5 L/ha (1 L/acre) + 1.56–2.1 L/ha (0.63–0.85 L/acre)	• Use **ONLY** with pedigreed (certified) corn seed designated as glyphosate tolerant or "Roundup Ready" corn. • Apply up to and including the 5 leaf stage of corn. • Atrazine will provide residual control of broadleaf weeds. *Numerous products exist. Refer to Table 9–8. Glyphosate Product Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant ("Roundup Ready") Corn, page 160 for a complete list.
glyphosate (0.9 kg/ha) + mesotrione (0.1 kg/ha) + atrazine (0.28 kg/ha) + non-ionic surfactant (0.2% v/v)	glyphosate (360 g/L)* + CALLISTO (480 g/L) + AATREX (480 g/L) + non-ionic surfactant	2.5 L/ha (1 L/acre) + 0.21 L/ha (0.085 L/acre) + 0.58 L/ha (0.235 L/acre) + 2 L/1,000 L	• Use **ONLY** with pedigreed (certified) corn seed designated as glyphosate tolerant or "Roundup Ready" corn. • Apply up to and including the 8 leaf stage of corn. • CALLISTO and Atrazine will provide residual broadleaf weed control. *Numerous products exist. Refer to Table 9–8. Glyphosate Product Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant ("Roundup Ready") Corn, page 160 for a complete list.

TABLE 9–9. Herbicide Treatment Rates for Glyphosate Tolerant ("Roundup Ready") Corn (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
One Pass Postemergence Tank-Mixes with Residual Control for Use in Glyphosate Tolerant Corn Only (cont'd)			
glyphosate(0.9 kg/ha) + isoxaflutole (52.5 g/ha) + atrazine (500 g/ha)	glyphosate (360 g/L)* + CONVERGE XT (sold as a co-pack): (CONVERGE FLEXX (240 g/L) + CONVERGE 480 (480 g/L))	2.5 L/ha (1 L/acre) + 220 mL/ha (89 mL/acre) + 1.04 L/ha (0.42 L/acre)	· Use **ONLY** with pedigreed (certified) corn seed designated as glyphosate tolerant or "Roundup Ready" corn. · Apply at the 1–3 leaf stage of corn. · See precautions for CONVERGE XT, page 141. *Numerous products exist. Refer to Table 9–8. Glyphosate Product Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant ("Roundup Ready") Corn, page 160 for a complete list.
glyphosate (0.9 kg/ha) + rimsulfuron (15 g/ha) + mesotrione (144 g/ha)	glyphosate (360 g/L)* + ENGARDE (sold as a co-pack): (ENGARDE 25SG + ENGARDE 480SC)	2.5 L/ha (1 L/acre) + 60 g/ha (24 g/acre) + 300 mL/ha (120 mL/acre)	· Use **ONLY** with pedigreed (certified) corn seed designated as glyphosate tolerant or "Roundup Ready" corn. · Apply early POST from the spike to the 2 leaf stage of corn · Use on corn with corn heat units (CHU) greater than 2,500. *Numerous products exist. Refer to Table 9–8. Glyphosate Product Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant ("Roundup Ready") Corn, page 160 for a complete list.
glyphosate (0.9 kg/ha) topramezone (0.0125 kg/ha) + dimethenamid (1.0 kg/ha) + atrazine (0.5 kg/ha)	glyphosate (360 g/L)* + IMPACT (336 g/L) + AATREX (480 g/L)	2.5 L/ha (1 L/acre) + 37 mL/ha (15 mL/acre) + 1.04 L/ha (0.42 L/acre)	· Use **ONLY** with pedigreed (certified) corn seed designated as glyphosate tolerant or "Roundup Ready" corn. · Apply up to and including the 7 leaf stage of corn. *Numerous products exist. Refer to Table 9–8. Glyphosate Product Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant ("Roundup Ready") Corn, page 160 for a complete list.
	glyphosate (360 g/L) + ARMEZON (336 g/L) + AATREX (480 g/L)		
glyphosate (0.9 kg/ha) + dicamba/atrazine (1–1.5 kg/ha)	glyphosate (360 g/L)* + MARKSMAN (393 g/L)	2.5 L/ha (1 L/acre) + 2.5–3.7 L/ha (1–1.5 L/acre)	· Use **ONLY** with pedigreed (certified) corn seed designated as as glyphosate tolerant or "Roundup Ready" corn. · Apply up to and including the 5 leaf stage of corn. · Marksman will provide residual control of broadleaf weeds. · See precautions for BANVEL II, ORACLE or HAWKEYE applied POST, page 146. *Numerous products exist. Refer to Table 9–8. Glyphosate Product Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant ("Roundup Ready") Corn, page 160 for a complete list.

TABLE 9–9. Herbicide Treatment Rates for Glyphosate Tolerant ("Roundup Ready") Corn (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
One Pass Postemergence Tank-Mixes with Residual Control for Use in Glyphosate Tolerant Corn Only (cont'd)			
glyphosate (0.9 kg/ha) + s-metolachlor/benoxacor/ atrazine (1.8 kg/ha)	glyphosate (360 g/L)* + PRIMEXTRA II MAGNUM ((1:0.8) 720 g/L)	2.5 L/ha (1 L/acre) + 2.5 L/ha (1.0 L/acre)	· Use **ONLY** with pedigreed (certified) corn seed designated as glyphosate tolerant or "Roundup Ready" corn. · Apply up to and including the 6 leaf stage of corn. · PRIMEXTRA II MAGNUM will provide residual grass and broadleaf weed control. · For tank-mixtures of PRIMEXTRA II MAGNUM plus any of the glyphosate products, to ensure optimum compatibility: Add PRIMEXTRA II MAGNUM to the tank first, then add AGRAL 90, AGSURF or COMPANION at 2.5 L/1,000 L. Continue agitation and add the glyphosate mix partner. * Numerous products exist. Refer to Table 9–8. Glyphosate Product Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant ("Roundup Ready") Corn, page 160 for a complete list.
glyphosate/s-metolachlor/ mesotrione (2,205 g/ha) + atrazine (0.28 kg/ha) + non-ionic surfactant (0.2% v/v)	HALEX GT (525 g/L) + AATREX (480 g/L) + non-ionic surfactant	4.2 L/ha (1.7 L/acre) + 0.58 L/ha (0.235 L/acre) + 2 L/1,000 L	· Use **ONLY** with pedigreed (certified) corn seed designated as glyphosate tolerant or "Roundup Ready" corn. · Apply up to and including the 6 leaf stage of corn. · The addition of atrazine improves control of wild buckwheat, cocklebur, lady's thumb, common and giant ragweed. · This treatment can be replicated by tank-mixing either TOUCHDOWN TOTAL or TRAXION at 1.8 L/ha (0.72 L/acre) with PRIMEXTRA II MAGNUM at 2.5 L/ha (1 L/acre) and CALLISTO at 210 mL/ha (84 mL/acre).
s-metolachlor/benoxacor/ atrazine/mesotrione (1,475 g/ha) + glyphosate (900 g/ha)	LUMAX EZ (298 g/L, 112 g/ L, 30 g/L) + glyphosate (360 g/L)	3.35 L/ha (1.36 L/acre) 2.5 L/ha (1 L/acre)	· Apply POST from the 3–6 leaf stage of field corn. · **Do NOT** apply to corn treated with an organophosphorous insecticide. · Use **ONLY** with pedigreed (certified) corn seed designated as glyphosate tolerant or "Roundup Ready" corn. * Numerous products exist. Refer to Table 9–8. Glyphosate Product Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant ("Roundup Ready") Corn, page 160 for a complete list.
halosulfuron (34–67.5 g/ha) + glyphosate + non-ionic surfactant (0.25% v/v)	PERMIT (72.6% WG) + glyphosate (360 g/L)* + non-ionic surfactant	47–93 g/ha (19–38 g/acre) + 2.5 L/ha (1 L/acre) + 2.5 L/1,000 L	· Apply when the corn is in the spike–10 leaf stage. · For sweet corn, the maximum use rate is 70 g/ha (28 g/acre). · The 47 g/ha (19 g/acre) rate will control labelled broadleaf weeds and nutsedge that is shorter than 15 cm. · The 70–90 g/ha (28–38 g/acre) will control nutsedge that is 15–30 cm tall. · Permit can be applied up to twice per season, but not to exceed a total of 140 g/ha (56 g/acre) in sweet corn and 186 g/ha (76 g/acre) in seed or field corn. * Numerous products exist. Refer to Table 9–8. Glyphosate Product Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant ("Roundup Ready") Corn, page 160 for a complete list.

TABLE 9–9. Herbicide Treatment Rates for Glyphosate Tolerant ("Roundup Ready") Corn (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
One Pass Postemergence Tank-Mixes with Residual Control for Use in Glyphosate Tolerant Corn Only (cont'd)			
tembotrione (37.5 g/ha)/ thiencarbazone-methyl (7.5 g/ha) + glyphosate (900 g/ha)	VIOS G3 (420 g/L) + glyphosate (360 g/L)*	110 mL/ha (44 mL/acre) 2.5 L/ha (1 L/acre)	· Use **ONLY** with pedigreed (certified) corn seed designated as glyphosate tolerant or "Roundup Ready" corn. · Apply up to and including the 6 leaf stage of corn. · Apply only 1 application of VIOS G3 per season. *Numerous products exist. Refer to Table 9–8. Glyphosate Product Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant ("Roundup Ready") Corn, page 160 for a complete list.
Two Pass Postemergence Treatments in Glyphosate Tolerant Corn Only			
glyphosate (0.9–1.8 kg/ha)	glyphosate (360 g/L)*	2.5–5 L/ha (1–2 L/acre)	· Use **ONLY** with pedigreed (certified) corn seed designated as glyphosate tolerant or "Roundup Ready" corn. The initial application should occur between the 3–5 leaf to remove early competition. A second application may be applied up to the 8 leaf stage of corn. · Use 100–200 L/ha (40–80 L/acre) of water. *Numerous products exist. Refer to Table 9–8. Glyphosate Product Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant ("Roundup Ready") Corn, page 160 for a complete list.
	other glyphosate products	See Table 9–8.	

Glufosinate Tolerant ("Liberty Link") Corn

Weed Management Strategies for Glufosinate Tolerant Corn

There are four main strategies that one can use to manage weeds in glufosinate tolerant ("Liberty Link") corn.

- A single application of LIBERTY.
- LIBERTY tank-mixed with a residual herbicide.
- Two in-crop applications of LIBERTY.
- A preemergence application with a residual herbicide followed with an in crop application of LIBERTY.

Grain yield and weed control associated with any of the above four strategies is similar to what has been observed by the University of Guelph in glyphosate tolerant corn, refer to Table 9–6. on page 156. In general, Liberty provides optimum weed control under hot humid conditions, when applications are made during the day (versus the morning or evening) and when spray coverage is thorough. Cool conditions, weed size, and dew on weed leaves will reduce the level of control of Liberty even at labeled rates.

NOTES: Weed control ratings are given as 0–9 where 0 indicates no control, and 9 indicates 90%–100% control under ideal conditions. Ratings are subjective values based on best available information and given general comparisons based on use as described in this guide. Under unfavourable conditions (e.g., too dry, too wet, too cold or poor application) the herbicides may not be as effective as indicated. Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used. Always refer to the product label for more information on registered weed species, product uses and precautions.x

TABLE 9–10. Glufosinate ("Liberty Link") Tolerant Corn Herbicide Weed Control Ratings

LEGEND: Numbers (0–9) = weed control ratings
– = insufficient information available to make a rating
R = populations resistant to this herbicide exist in Ontario and won't be adequately controlled if present
Crop tolerance ratings: E = Excellent, G = Good, F = Fair, P = Poor
* = sold as a co-pack under this trade name

		Annual Grasses									**Annual Broadleaves**												**Perennials**							
Trade Name	**Weed Stage**	**barnyard grass**	**smooth crabgrass**	**large crabgrass**	**fall panicum**	**foxtail, giant**	**foxtail, green**	**foxtail, yellow**	**witchgrass**	**proso millet**	**buckwheat, wild**	**cocklebur**	**corn spurry**	**fleabane, Canada**	**lady's thumb**	**lamb's-quarters**	**mustards**	**nightshades**	**pigweeds**	**ragweed, common**	**ragweed, giant**	**velvetleaf**	**bindweed, field**	**horsetail**	**milkweed**	**nutsedge**	**quackgrass**	**sow-thistle**	**thistle, Canada**	**Crop Tolerance**
Preplant Burndown Herbicides																														
Refer to Tables 6–1. Non-Selective Herbicides Available for Preplant Site Preparation, page 91 and 6–2. Preplant Herbicide Weed Control Ratings, page 93 for a list of herbicides and weed control ratings.																														
Preemergence Herbicides with Limited Residual Weed Control – May Require a Postemergence Application of LIBERTY 200 SN ("Liberty Link" Hybrids Only)																														
BATTALION*	un-emerged	9	8	8	9	8	8	8	9	9^{1}	9	–	8	8	8	9	8	8	9	9	7	8	–	–	–	–	7^{1}	7^{1}	–	G
CONVERGE XT*	un-emerged	9	9	9	9	9	7	9	9	9	9	7	–	6	9	9	9	9	9	9	6	9	–	0	0	0	0	0	0	G
ENGARDE*	un-emerged	9	8	8	9	9	9	7	9	9	9	5	8	–	9	9	9	9	9	8	-	9	-	-	-	8	7	-	-	E
INTEGRITY	un-emerged	9	8	7	–	8	8	8	9	4	9	8	–	9	9	9	9	7	9	9	5	9	0	5	0	6	0	0	0	E
FOCUS*	un-emerged	9	9	8	–	9	9	9	–	–	8	–	–	–	–	8	9	9	9	7	–	6	–	–	–	–	–	–	–	E
LUMAX EZ	un-emerged	9	9	9	8^{1}	8	8	8	9	4	8	8	–	8	9	9	9	9	9	8	8^{5}	9	–	–	–	–	–	–	–	E
PRIMEXTRA II MAGNUM	un-emerged	9	8	8	8	8	8	8	9	2	9	7	9	6	9	9^{R}	9	9	9^{R}	9^{R}	–	5	0	0	0	3	0	0	0	E
PROWL H2O + AATREX	un-emerged	9	–	–	–	–	8	8	–	–	9	7	9	5	9	9^{R}	9	9	9^{R}	8^{R}	6	6	2	0	0	0	0	2	2	E
PROWL H2O + MARKSMAN	un-emerged	9	–	–	–	–	8	8	–	–	9	9	9	9	9	9	9	9	9	8	7	8	8^{1}	0	0	0	0	8^{1}	8^{1}	E
One Pass Postemergence Non-Residual Herbicides for "Liberty Link" Hybrids Only																														
LIBERTY 200 SN[2]	emerged weeds	9	9	9	9	9	9	8/9	9	9	8	9	–	4	8/9	8	9	9	9	9	–	8	6	6	–	6	6/7	8	7	E[2]

[1] Weed must be emerged to achieve this level of control.

[2] For use on "Liberty Link" corn (glufosinate tolerant) only.

TABLE 9–10. Glufosinate ("Liberty Link") Tolerant Corn Herbicide Weed Control Ratings (cont'd)

LEGEND: Numbers (0–9) = weed control ratings
– = insufficient information available to make a rating
R = populations resistant to this herbicide exist in Ontario and won't be adequately controlled if present
Crop tolerance ratings: E = Excellent, G = Good, F = Fair, P = Poor
* = sold as a co-pack under this trade name

		Annual Grasses									Annual Broadleaves												Perennials							
Trade Name	**Weed Stage**	**barnyard grass**	**smooth crabgrass**	**large crabgrass**	**fall panicum**	**foxtail, giant**	**foxtail, green**	**foxtail, yellow**	**witchgrass**	**proso millet**	**buckwheat, wild**	**cocklebur**	**corn spurry**	**fleabane, Canada**	**lady's thumb**	**lamb's-quarters**	**mustards**	**nightshades**	**pigweeds**	**ragweed, common**	**ragweed, giant**	**velvetleaf**	**bindweed, field**	**horsetail**	**milkweed**	**nutsedge**	**quackgrass**	**sow-thistle**	**thistle, Canada**	**Crop Tolerance**
One Pass Tank-Mixes with Residual Weed Control for "Liberty Link" Hybrids Only																														
LIBERTY 200 SN[2] + AATREX	emerged weeds	9	9	9	9	9	9	8/9	9	9	8	9	9	5	8/9	8	9	9	9	9	–	8/9	6	6	–	6	6/7	8	7	E[2]
	residual weed control	2	2	2	2	2	2	2	2	2	9	7	9	5	9	9^R	9	9	9^R	9^R	6	5	2	0	0	0	0	0	0	E[2]
LIBERTY 200 SN[2] + BANVEL II	emerged weeds	9	9	9	9	9	9	8/9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	8	6	–	6	6/7	9	8	E[2]
	residual weed control	0	0	0	0	0	0	0	0	0	8	7	8	9	9	9	6	9	9	9	7	8	2	0	0	0	0	2	2	E[2]
LIBERTY 200 SN[2] + DISTINCT	emerged weeds	9	9	9	9	9	9	8/9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	8	6	–	6	6/7	9	9	E[2]
LIBERTY 200 SN[2] + MARKSMAN	emerged weeds	9	9	9	9	9	9	8/9	9	9	9	9	–	9	9	9	9	9	9	9	9	9	8	6	–	6	6/7	8	8	E[2]
	residual weed control	2	2	2	2	2	2	2	2	2	9	7	9	9	9	9	9	9	9	9	7	8	2	0	0	0	2	2	2	E[2]
LIBERTY 200 SN[2] + PROWL H20	emerged weeds	9	9	9	9	9	9	8/9	9	9	8	9	–	4	8/9	9	9	9	9	9	–	8	6	6	–	6	6/7	8	7	E[2]
	residual weed control	9	9	9	9	8	8	8	–	5	–	–	–	0	6	9	0	8	8	2	–	6	–	–	–	–	–	–	–	E[2]
VIOS G3 + LIBERTY 200 SN[2]	emerged weeds	9	9	9	9	9	9	9	9	9	8	9	–	4	9	8	9	9	9	9	–	9	6	6	–	6	6/7	8	7	E[2]
	residual weed control	9	8	8	9	9	9	9	9	7	9	–	–	4	9	9	9	9	9	9	–	8	–	–	–	0	–	0	–	E[2]

[1] Weed must be emerged to achieve this level of control.

[2] For use on "Liberty Link" corn (glufosinate tolerant) only.

NOTES: Weed control ratings are given as 0–9 where 0 indicates no control, and 9 indicates 90%–100% control under ideal conditions. Ratings are subjective values based on best available information and given general comparisons based on use as described in this guide. Under unfavourable conditions (e.g., too dry, too wet, too cold or poor application) the herbicides may not be as effective as indicated. Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used. Always refer to the product label for more information on registered weed species, product uses and precautions.

TABLE 9–11. Additional Weed Control Ratings for Glufosinate ("Liberty Link") Corn

LEGEND: Numbers (0–9) = weed control ratings – = insufficient information available to make a rating

	Volunteer Crops		Grasses			Annual and Biennial Broadleaves												Perennials			
Trade Name	adzuki beans (volunteer)	wheat (volunteer)	sandbur	stink grass	tufted love grass	bur-cucumber	biennial wormwood	chickweed, common	flower of an hour	lettuce, prickly	nipplewort	spreading atriplex	swamp smartweed	three seeded mercury	waterhemp	wild carrot	wood-sorrel (oxalis)	horsenettle	red top	vetch, tufted	wirestem muhly
Postemergence Grass and Broadleaf Herbicides ("Liberty Link" Hybrids Only)																					
LIBERTY 200 SN[1]	–	–	7	–	–	4	–	–	7	–	–	–	1	6	–	–	–	7	–	–	8
LIBERTY 200 SN[1] + AATREX	–	–	7	–	–	5	8	9	7	–	9	2	0	9	0	2	9	7	–	–	8
LIBERTY 200 SN[1] + BANVEL II	–	–	7	–	–	2	9	9	9	8	9	7	6	7	9	6	9	7	–	8	8
LIBERTY 200 SN[1] + DISTINCT	–	–	7	–	–	4	9	9	9	8	9	7	5	9	9	8	–	7	–	8	8
LIBERTY 200 SN[1] + MARKSMAN	–	–	7	–	–	6	9	9	9	9	9	7	3	9	9	9	–	7	–	8	8

[1] For use on "Liberty Link" (glufosinate tolerant) corn only.

TABLE 9–12. Herbicide Treatment Rates for Glufosinate Tolerant ("Liberty Link") Corn

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Preplant Burndown and Residual Control			
Non-selective herbicides such as glyphosate and GRAMAXONE are used to control emerged weeds prior to no-till planting. Tank-mixing of a residual herbicide with glyphosate or GRAMAXONE can be used to improve application efficiency with a one pass weed management program. Refer also to Chapter 6, Preplant & Postharvest Weed Control, page 91 for preplant application rates for glyphosate and GRAMAXONE. It is also important to note that when targeting perennial weeds, the addition of a triazine-based herbicide (i.e. atrazine, Converge, Primextra II Magnum) will reduce the level of activity achieved with glyphosate. Increasing the rate of glyphosate should overcome this antagonism.			
Preemergence Herbicides with Limited Residual Weed Control – May Require a Postemergence Application of LIBERTY 200 SN ("Liberty Link") Hybrids Only			
rimsulfuron (12.5 g/ha) + s-metolachlor/benoxacor (573 g/ha) + dicamba (300 g/ha)	BATTALION (sold as a co-pack): ELIM EP (25 DF) + DUAL II MAGNUM (915 g/L) + BANVEL II (480 g/L)	 50 g/ha (20 g/acre) + 0.625 L/ha (0.25 L/acre) + 0.625 L/ha (0.25 L/acre)	- Use **ONLY** on glufosinate tolerant ("Liberty Link") corn hybrids. - See precautions for BATTALION, page 140. - A postemergence application of LIBERTY applied at the 7–8 leaf stage of corn may be necessary for the control of perennial weeds or weed escapes.
isoxaflutole (52.5 g/ha) + atrazine (532 g/ha)	CONVERGE XT (sold as a co-pack): CONVERGE FLEXX (240 g/L) + CONVERGE 480 (480 g/L)	 220 mL/ha (89 mL/acre) + 1.1 L/ha (0.44 L/acre)	- Use **ONLY** on glufosinate tolerant ("Liberty Link") corn hybrids. - Use for early season weed control through the critical crop establishment phase. - Use in a planned weed management program with a post-emergent application of LIBERTY 200 SN. - See precautions for CONVERGE XT, page 141.
rimsulfuron (15 g/ha) + mesotrione (144 g/ha)	ENGARDE (sold as a co-pack): ENGARDE 25SG + ENGARDE 480SC	 60 g/ha (24 g/acre) + 300 mL/ha (120 mL/acre)	- Apply PRE or Early POST up to the 2 leaf stage of corn. - Engarde can be applied with 28% UAN as a carrier **(PRE only).** - Can be tank-mixed with glyphosate for emerged annual and perennial weeds. See Chapter 6, Preplant & Postharvest Weed Control, page 91 for more information.
carfentrazone-ethyl (8.76 g/ha) + pyroxasulfone (100 g/ha)	FOCUS (sold as a co-pack): AIM EC (240g/L) + PYROXASULFONE (85 WG)	 36.5 mL/ha (15 mL/acre) + 118 g/ha (48 g/acre)	- Apply PP or PRE. - **Do NOT** use on peat or muck soils and soils with 7% or more organic matter content. - Moisture is necessary to activate the active ingredient pyroxasulfone in soil for weed control. - The AIM EC component will only control emerged broadleaf weeds at application.
saflufenacil/dimethenamid-P (488 g/ha)	INTEGRITY (668 g/L)	0.73 L/ha (0.292 L/acre)	- Use **ONLY** on glufosinate tolerant ("Liberty Link") corn hybrids. - A postemergence application of LIBERTY applied at the 7–8 leaf stage of corn may be necessary for the control of perennial weeds or weed escapes. - See precautions for INTEGRITY, page 138.

TABLE 9–12. Herbicide Treatment Rates for Glufosinate Tolerant ("Liberty Link") Corn (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Preemergence Herbicides with Limited Residual Weed Control – May Require a Postemergence Application of LIBERTY 200 SN ("Liberty Link") Hybrids Only (cont'd)			
s-metolachlor/benoxacor/ atrazine/mesotrione (1,475 g/ha)	LUMAX EZ (298 g/L, 112 g/L, 30 g/L)	3.35 L/ha (1.36 L/acre)	· Apply surface pre-plant up to 7 days prior to planting, PRE or Early POST up to the 2 leaf stage of field corn. · Grassy weeds beyond the 2 leaf stage will not be controlled. · **Do NOT** apply to corn treated with an organophosphorous insecticide. · This rate of LUMAX EZ will provide suppression through the critical crop establishment phase and is to be used in a planned weed management program with a postemergent herbicide treatment.
s-metolachlor/benoxacor/ atrazine (1.8 kg/ha)	PRIMEXTRA II MAGNUM ((1:0.8) 720 g/L)	2.5 L/ha (1 L/acre)	· Use **ONLY** on glufosinate tolerant ("Liberty Link") corn hybrids. · This reduced rate of PRIMEXTRA II MAGNUM (1 L/acre) provides suppression of labeled weeds and is part of a planned weed management program that includes a follow-up postemergence treatment of LIBERTY.
pendimethalin (1 kg/ha) + atrazine (1 kg/ha)	PROWL H20 (455 g/L) + AATREX (480 g/L)	2.2 L/ha (0.89 L/acre) + 2.1 L/ha (0.83 L/acre)	· Use **ONLY** on glufosinate tolerant ("Liberty Link") corn hybrids. · A postemergence application of LIBERTY applied at the 7–8 leaf stage of corn may be necessary for the control of perennial weeds or weed escapes. · See precautions for PROWL H20 alone, page 144 and AATREX alone, page 139.
pendimethalin (1 kg/ha) + dicamba/atrazine (1 kg/ha)	PROWL H20 (455 g/L) + MARKSMAN (393 g/L)	2.2 L/ha (0.89 L/acre) + 2.5 L/ha (1 L/acre)	· Use **ONLY** on glufosinate tolerant ("Liberty Link") corn hybrids. · A postemergence application of LIBERTY applied at the 7–8 leaf stage of corn may be necessary for the control of perennial weeds or weed escapes. · See precautions for PROWL H20 alone, page 144 and MARKSMAN alone, page 139.
One Pass Postemergence Non-Residual Herbicides for Glufosinate ("Liberty Link") Tolerant Corn Only			
glufosinate ammonium (0.5 kg/ha)	LIBERTY 200 SN (200 g/L)	2.5 L/ha (1 L/acre)	· Use **ONLY** on field and seed corn specially developed to be tolerant to LIBERTY 200 SN. · LIBERTY 200 SN can be applied from the 1–8 leaf stage of corn. · LIBERTY 200 SN is a contact herbicide and has no residual activity. Consult the product label for rate recommendations for specific weeds and weed stages. Ammonium sulphate can be applied at 6 L/ha (2.4 L/acre) (liquid) or 3.3 kg/ha (1.3 kg/acre) (dry) for improved control of specific weeds. · **Do NOT** add oil or any other surfactants.

TABLE 9–12. Herbicide Treatment Rates for Glufosinate Tolerant ("Liberty Link") Corn (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
One Pass Tank-Mixes with Residual Control for Glufosinate ("Liberty Link") Tolerant Corn Only			
glufosinate ammonium (0.5 kg/ha) + atrazine (0.84–1.12 kg/ha)	LIBERTY 200 SN (200 g/L) + AATREX (480 g/L)	2.5 L/ha (1 L/acre) + 1.75–2.34 L/ha (0.7–0.93 L/acre)	• Use **ONLY** on glufosinate tolerant ("Liberty Link") corn hybrids. • This tank-mix can be applied up to the 8 leaf stage of corn.
glufosinate ammonium (0.5 kg/ha) + dicamba (0.3 kg/ha)	LIBERTY 200 SN (200 g/L) + BANVEL II (480 g/L)	2.5 L/ha (1 L/acre) + 0.625 L/ha (0.25 L/acre)	• Use **ONLY** on glufosinate tolerant ("Liberty Link") corn hybrids. • This tank-mix can be applied up to the 5 leaf stage of corn. • See precautions for BANVEL II, ORACLE or HAWKEYE alone POST, page 139.
diflufenzopyr/dicamba (0.2 kg/ha)	LIBERTY 200 SN (200 g/L) + DISTINCT (70 WG)	2.5 L/ha (1 L/acre) + 0.285 kg/ha (0.114 kg/ha)	• Use **ONLY** on glufosinate tolerant ("Liberty Link") corn hybrids. • This tank-mix can be applied up to the 5 leaf stage of corn. • See precautions for DISTINCT alone POST, page 147.
glufosinate ammonium (0.5 kg/ha) + dicamba/atrazine (1–1.5 kg/ha)	LIBERTY 200 SN (200 g/L) + MARKSMAN (393 g/L)	2.5 L/ha (1 L/acre) + 2.5–3.7 L/ha (1–1.5 L/acre)	• Use **ONLY** on glufosinate tolerant ("Liberty Link") corn hybrids. • This tank-mix can be applied up to the 5 leaf stage of corn. • See precautions for BANVEL II, ORACLE or HAWKEYE alone POST, page 139.
glufosinate ammonium (0.5 kg/ha) + pendimethalin (1 kg/ha)	LIBERTY 200 SN (200 g/L) + PROWL H2O (455 g/L)	2.5 L/ha (1 L/acre) + 2.2 L/ha (0.89 L/acre)	• Use **ONLY** on glufosinate tolerant ("Liberty Link") corn hybrids. • This tank-mix can be applied up to the 4 leaf stage of corn.
tembotrione (37.5 g/ha)/ thiencarbazone-methyl (7.5 g/ha) + glufosinate ammonium (0.5 kg/ha)	VIOS G3 (420 g/L) + LIBERTY 200 SN (200 g/L)	110 mL/ha (44 mL/acre) + 2.5 L/ha (1 L/acre)	• Use **ONLY** on glufosinate tolerant ("Liberty Link") corn hybrids. • Apply up to and including the 6 leaf stage of corn. • Apply only 1 application of VIOS G3 per season.
Two Pass Postemergence Treatments for Glufosinate ("Liberty Link") Tolerant Corn Only			
glufosinate ammonium (0.5 kg/ha) followed by glufosinate ammonium (0.4 kg/ha)	LIBERTY 200 SN (200 g/L) followed by LIBERTY 200 SN (200 g/L)	2.5 L/ha (1 L/acre) followed by 2 L/ha (0.8 L/acre)	• Use **ONLY** on glufosinate tolerant ("Liberty Link") corn hybrids. • The first application may be applied on 2–4 leaf stage of corn at the proper growth stage of the weeds. The second application may be made up to the 8 leaf stage of corn to control subsequent flushes of weeds.

Enlist Field Corn

Weed Management Strategies for Enlist Field Corn

A weed management strategy that includes a preemergence application with a residual herbicide followed by an in crop application of Enlist Duo is the preferred approach. Please refer to Table 9–9. for Preemergence Herbicides with Limited Residual Weed Control, page 161. A preemergence herbicide application with limited residual control may require a post emergent Enlist Duo application (Enlist Tolerant Hybrids Only).

NOTES: Weed control ratings are given as 0–9 where 0 indicates no control, and 9 indicates 90%–100% control under ideal conditions. Ratings are subjective values based on best available information and given general comparisons based on use as described in this guide. Under unfavourable conditions (e.g., too dry, too wet, too cold or poor application) the herbicides may not be as effective as indicated. Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used. Always refer to the product label for more information on registered weed species, product uses and precautions.

TABLE 9–13. Weed Control for Enlist Field Corn

LEGEND:

	Annual Grasses									**Annual Broadleaves**												**Perennials**							
Trade Name	**barnyard grass**	**smooth crabgrass**	**large crabgrass**	**fall panicum**	**foxtail, giant**	**foxtail, green**	**foxtail, yellow**	**witch grass**	**proso millet**	**buckwheat, wild**	**cocklebur**	**corn spurry**	**fleabane, Canada**	**lady's thumb**	**lamb's-quarters**	**mustards**	**nightshades**	**pigweeds**	**ragweed, common**	**ragweed, giant**	**velvetleaf**	**bindweed, field**	**horsetail**	**milkweed**	**nutsedge**	**quackgrass**	**sow-thistle**	**thistle, Canada**	**Crop Tolerance**
Postemergence Herbicides for Enlist Hybrids Only																													
ENLIST DUO	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	8	7	9	8	9	9	9	E

TABLE 9–14. Herbicide Treatment Rates for Enlist Field Corn

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Postemergence Herbicides for Enlist Hybrids Only			
2,4-D choline salt (194 g/L) + glyphosate (204 g/L)	ENLIST DUO	2.9–4.3 L/ha (1.17–1.74 L/acre)	· Apply POST up to the 8 leaf stage of Enlist corn. · Make 1 to 2 applications with a minimum of 12 days between applications. · Two applications may be necessary for control of perennial weeds or late weed flushes that emerged after the initial application. · Apply as a coarse to extremely coarse spray (ASABE S-572 Standard). · Re-entry interval is 48 hours after application. · **Do NOT** apply more than two post emergent applications per use season. · **Do NOT** apply more than 8.6 L/ha of ENLIST DUO herbicide per use season. · Read and follow the Stewardship Program (www.traitstewardship.com) that accompanies the use of field corn seed containing the DAS-40278-9 gene.

TABLE 9–15. Maximum Weed Leaf Stages (or Height) for Postemergence Herbicide Applications in Corn

Notes: Herbicide performance is improved when a product is applied at the appropriate rate, crop and weed stage. This table provides information on ideal crop stage, maximum leaf stage of the weed that a product must be applied to minimize poor performance.

LEGEND: — = either the weed is not controlled by the corresponding herbicide, or not enough data is available to specify a maximum leaf stage.
* = herbicide sold as a co-pack under this trade name

Trade Name	Application Window (corn leaf-over stage)	Annual Grass Weeds: Maximum Leaf Stage[1]						Annual Broadleaf Weeds: Maximum Leaf Stage[1]										Perennials
		barnyard grass	crabgrass	fall panicum	foxtail, green	witchgrass	proso millet	buckwheat, wild	cocklebur	jimsonweed	lady's-thumb	lamb's-quarters	wild mustard	nightshade	pigweed	ragweed	velvetleaf	quackgrass
Postemergence Grass Herbicides																		
ACCENT	1–8 leaf	6	—	6	6	6	6	—	—	—	—	—	—	—	—	—	—	3–6
DUAL II MAGNUM	PRE–3 leaf	1	1	1	1	1	1	—	—	—	—	—	—	PRE	PRE	—	—	—
FRONTIER MAX	PRE–3 leaf	1	1	1	1	1	1	—	—	—	—	—	—	PRE	PRE	—	—	—
ULTIM	1–6 leaf	6	—	6	6	6	6	—	—	—	—	—	—	—	6	—	—	3–6
Postemergence Broadleaf Herbicides																		
AATREX	tolerant at all stages	—	—	—	—	—	—	PRE	—	10 cm	10 cm	10 cm	10 cm	10 cm	10 cm	7–10 cm	5–10 cm	—
BANVEL II, ORACLE **or** HAWKEYE	up to 5 leaf	—	—	—	—	—	—	4	4	4	4	4	4	4	4	4	4	—
BUCTRIL M **or** BADGE **or** MEXTROL **or** LOGIC M	4–6 leaf	—	—	—	—	—	—	8	4	—	4	8	8	—	4	8	4	—
CALLISTO + AATREX	3–8 leaf	—	—	—	—	—	—	8	4	4	8	8	—	8	8	6	8	—
DISTINCT	2–6 leaf	—	—	—	—	—	—	6	6	6	6–8	6	6	6	6	6	6	—
(IMPACT **or** AMERZON) + AATREX	1–7 leaf	4	—	—	4	—	—	—	—	5	—	8	8	8	8	8	8	—
MARKSMAN **or** PROPERO	up to 5 leaf	—	—	—	—	—	—	4	4	4	4	4	4	4	4	4	4	—
PARDNER **or** BROMOTRIL **or** BROTEX **or** KORIL	4–8 leaf	—	—	—	—	—	—	8	4	—	4	8	4	—	4	4	4	—
(PARDNER **or** BROMOTRIL **or** BROTEX **or** KORIL) + AATREX	4–8 leaf	—	—	—	—	—	—	8	4	—	4	8	4	—	6	8	6	—
PEAKPLUS	up to 7 leaf	—	—	—	—	—	—	—	6	5	4	6	12	—	6	8	6	—

[1] Expressed as leaf stages except as indicated.

[2] For use only on glyphosate tolerant ("Roundup Ready") corn hybrids.

[3] For use only on glufosinate tolerant ("Liberty Link") corn hybrids.

TABLE 9–15. Maximum Weed Leaf Stages (or Height) for Postemergence Herbicide Applications in Corn (cont'd)

Notes: Herbicide performance is improved when a product is applied at the appropriate rate, crop and weed stage. This table provides information on ideal crop stage, maximum leaf stage of the weed that a product must be applied to minimize poor performance.

LEGEND: — = either the weed is not controlled by the corresponding herbicide, or not enough data is available to specify a maximum leaf stage.
* = herbicide sold as a co-pack under this trade name

		Annual Grass Weeds: Maximum Leaf Stage[1]						**Annual Broadleaf Weeds: Maximum Leaf Stage**[1]										**Perennials**
Trade Name	**Application Window (corn leaf-over stage)**	**barnyard grass**	**crabgrass**	**fall panicum**	**foxtail, green**	**witchgrass**	**proso millet**	**buckwheat, wild**	**cocklebur**	**jimsonweed**	**lady's-thumb**	**lamb's-quarters**	**wild mustard**	**nightshade**	**pigweed**	**ragweed**	**velvetleaf**	**quackgrass**
Postemergence Broadleaf and Grass Herbicides																		
ACCENT TOTAL**	2–8 leaf	6	—	6	6	6	6	6	6	6	6–8	6	6	6	6	6	6	3–6
BATTALION**	PRE–3 leaf	3	PRE	3	3	3	3	4	4	4	4	4	4	4	4	4	4	3
GALAXY 2**[2]	1–6 leaf	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8
glyphosate[2]	up to 8 leaf	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	—
HALEX[2]	spike to 6	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	—
(IMPACT or AMERZON) + FRONTIER MAX + AATREX	1–7 leaf	4	—	—	4	—	—	—	—	5	—	8	8	8	8	8	8	—
LIBERTY[3]	up to 8 leaf	5	5	4	5	4	5	—	4	—	6	6	4	—	6	7	4	1–4
OPTION 2.25OD	up to 8 leaf	6	—	4	5	4	5	—	—	—	—	8	7	5	7	4	4	6
PRIMEXTRA	PRE–3 leaf	2	2	2	2	2	2	PRE	—	2	2	2	2	2	2	2	2	—
ULTIM TOTAL**	2–6 leaf	6	—	6	6	6	6	6	6	6	6–8	6	6	6	6	6	6	3–6
VIOS G3	1–6 leaf	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	—

[1] Expressed as leaf stages except as indicated.

[2] For use only on glyphosate tolerant ("Roundup Ready") corn hybrids.

[3] For use only on glufosinate tolerant ("Liberty Link") corn hybrids.

10. FORAGE CROPS

NOTES: Weed control ratings are given as 0–9 where 0 indicates no control and 9 indicates 90%–100% control under ideal conditions. Ratings are subjective values based on best available information and give general comparisons based on use as described in this guide. Under unfavourable conditions (e.g., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated. Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used. Please see product label for more information on registered weed species, product uses and precautions.

TABLE 10–1. Forages Herbicide Weed Control Ratings

LEGEND: Numbers (0–9) = weed control ratings – = insufficient information available to make a rating ✓ = can be used on this crop x = not indicated for use on this crop

	Crop									Grasses								Annual Broadleaves													Perennials									
Trade Name	seedling alfalfa	seedling birdsfoot trefoil	seedling clovers	seedling forage grasses	established alfalfa	established birdsfoot trefoil	established clovers	pasture (mostly grasses)	forage sorghum and pearl millet	barnyard grass	crabgrass	fall panicum	foxtail, giant	foxtail, green	foxtail, yellow	witchgrass	wild oats	buckwheat, wild	chickweed, common	cleavers	corn spurry	fleabane, Canada	hempnettle	lady's thumb	lamb's-quarters	mustards	pigweeds	ragweed, common	ragweed, giant	velvetleaf	bindweed, field	chickweed, mouseeared	curled dock	dandelion	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada
Soil Applied Grass Herbicides																																								
EPTAM	✓	✓	x	x	x	x	x	x	x	9	9	9	9	9	9	–	–	6	7	–	–	0	–	7	9	6	9	2	0	–	–	–	0	0	0	0	8	2	0	0
TREFLAN **or** RIVAL **or** BONANZA	✓	x	x	x	x	x	x	x	x	9	9	9	9	9	9	9	8	5	–	–	–	0	5	2	8	2	8	2	1	3	–	–	0	0	0	0	0	0	0	0
Postemergence Grass Herbicides																																								
ACHIEVE LIQUID **or** BISON[1]	x	x	x	✓	x	x	x	x	x	8	–	–	–	9	9	–	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
ASSURE II/ YUMA GL[1]	x	x	x	x	✓	x	x	x	x	9	8	9	9	9	9	9	–	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0
VENTURE L	✓	✓	✓	x	✓	✓	✓	x	x	9	8	9	8	8	8	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0
KERB	x	x	x	x	✓	✓	x	x	x	8	8	6	–	8	8	–	–	–	8	0	0	0	0	0	0	0	6	0	5	0	0	0	0	0	0	0	0	8	0	0
POAST ULTRA	✓	✓	✓	x	✓	x	✓	x	x	9	8	9	9	9	9	9	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0
SELECT **or** ARROW	✓	x	x	x	x	x	x	x	x	9	8	9	9	9	9	9	–	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0
Postemergence Broadleaf Herbicides																																								

[1] For seed crops only.

[2] Various formulations available, see Table 4–1, *Herbicides Used in Ontario*, page 30. See label for specific uses and rates.

[3] Do not use on sweet clover.

[4] On established legumes, use fall spot treatment only.

[5] CLOVITOX PLUS and TOPSIDE not for established clovers.

[6] SIMADEX not for established alfalfa.

TABLE 10–1. Forages Herbicide Weed Control Ratings (cont'd)

LEGEND: Numbers (0–9) = weed control ratings – = insufficient information available to make a rating ✓ = can be used on this crop x = not indicated for use on this crop

	Crop									Grasses								Annual Broadleaves													Perennials									
Trade Name	**seedling alfalfa**	**seedling birdsfoot trefoil**	**seedling clovers**	**seedling forage grasses**	**established alfalfa**	**established birdsfoot trefoil**	**established clovers**	**pasture (mostly grasses)**	**forage sorghum and pearl millet**	**barnyard grass**	**crabgrass**	**fall panicum**	**foxtail, giant**	**foxtail, green**	**foxtail, yellow**	**witchgrass**	**wild oats**	**buckwheat, wild**	**chickweed, common**	**cleavers**	**corn spurry**	**fleabane, Canada**	**hempnettle**	**lady's thumb**	**lamb's-quarters**	**mustards**	**pigweeds**	**ragweed, common**	**ragweed, giant**	**velvetleaf**	**bindweed, field**	**chickweed, mouseeared**	**curled dock**	**dandelion**	**horsetail**	**milkweed**	**nutsedge**	**quackgrass**	**sow-thistle**	**thistle, Canada**
2,4-D[2]	x	x	x	✓	x	x	x	✓	✓	0	0	0	0	0	0	0	0	4	7	–	–	–	–	4	9	9	9	8	–	8	–	–	7	7	–	0	0	0	8	8
2,4-DB: CALIBER[3,4] **or** COBUTOX[3,4] **or** EMBUTOX[3,4]	✓	✓	✓	✓	✓	✓	✓	✓	x	0	0	0	0	0	0	0	0	4	5	–	–	–	–	4	7	8	9	8	–	8	8	–	–	–	–	–	0	0	8	8
BANVEL II **or** ORACLE	x	x	x	x	x	x	x	✓	x	0	0	0	0	0	0	0	0	8	–	8	9	8	–	9	9	7	7	9	8	9	8	–	9	7	–	0	0	0	9	8
BASAGRAN	✓	x	✓	✓	✓	x	x	x	✓	0	0	0	0	0	0	0	0	7	–	–	–	5	–	9	7	9	7	8	6	9	6	–	–	–	–	2	8	0	6	7
INFINITY	x	x	x	✓[1]	x	x	x	x	x	0	0	0	0	0	0	0	0	9	9	8	–	8	9	9	9	9	9	9	7	9	–	–	–	7	–	–	–	0	7	7
MCPA[2]	x	x	x	x	x	x	x	✓	x	0	0	0	0	0	0	0	0	4	–	4	–	–	8	–	9	9	8	8	–	8	7	–	–	–	8	–	0	0	6	5
MILESTONE	x	x	x	x	x	x	x	✓	x	0	0	0	0	0	0	0	0	9	–	8	–	–	–	–	–	–	–	9	–	–	9	–	–	6	–	–	–	–	9	9
PARDNER or bromoxynil[2]	x	x	x	x	x	x	x	x	✓	0	0	0	0	0	0	0	0	8	2	–	2	–	2	8	9	7	7	9	–	9	5	–	–	–	0	0	0	0	6	5
PEAK + BANVEL II	x	x	x	x	x	x	x	x	✓	0	0	0	0	0	0	0	0	8	9	–	–	7	–	9	9	9	9	9	7	9	–	–	–	5	–	–	–	–	7	7
TOPSIDE[5] **or** TROPOTOX PLUS **or** CLOVITOX PLUS[5]	x	x	✓	✓	x	x	✓	✓	x	0	0	0	0	0	0	0	0	7	2	–	–	–	8	–	9	9	9	8	–	9	8	–	–	–	–	–	0	0	9	9

[1] For seed crops only.

[2] Various formulations available, see Table 4–1, *Herbicides Used in Ontario*, page 30. See label for specific uses and rates.

[3] Do not use on sweet clover.

[4] On established legumes, use fall spot treatment only.

[5] CLOVITOX PLUS and TOPSIDE not for established clovers.

[6] SIMADEX not for established alfalfa.

TABLE 10–1. Forages Herbicide Weed Control Ratings (cont'd)

LEGEND: Numbers (0–9) = weed control ratings – = insufficient information available to make a rating ✓ = can be used on this crop x = not indicated for use on this crop

	Crop									Grasses								Annual Broadleaves													Perennials									
Trade Name	seedling alfalfa	seedling birdsfoot trefoil	seedling clovers	seedling forage grasses	established alfalfa	established birdsfoot trefoil	established clovers	pasture (mostly grasses)	forage sorghum and pearl millet	barnyard grass	crabgrass	fall panicum	foxtail, giant	foxtail, green	foxtail, yellow	witchgrass	wild oats	buckwheat, wild	chickweed, common	cleavers	corn spurry	fleabane, Canada	hempnettle	lady's thumb	lamb's-quarters	mustards	pigweeds	ragweed, common	ragweed, giant	velvetleaf	bindweed, field	chickweed, mouseeared	curled dock	dandelion	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada
Postemergence Grass and Broadleaf Herbicides																																								
GRAMOXONE	x	x	x	x	✓	✓	x	x	x	8	7	9	–	9	9	–	–	9	9	–	–	–	–	9	8	9	9	9	9	–	–	–	0	0	–	0	0	5	0	0
PRINCEP NINE-T **or** SIMADEX[6] **or** SIMAZINE	x	x	x	x	✓	✓	✓	x	x	6	8	8	–	–	8	8	9	9	–	–	–	–	–	9	9	9	9	8	–	6	7	–	–	–	–	–	–	6	–	–
PURSUIT **or** PHANTOM **or** NU-IMAGE[1]	✓[1]	x	x	x	✓	x	x	x	x	8	7	7	7	9	9	8	8	8	–	–	–	2	–	9	9	9	9	8	6	9	2	–	–	6	2	2	7	5	2	2
Postemergence Tank-Mixes																																								
2,4-DB[2] + MCPA[2,3,4]	✓	x	x	x	x	x	x	x	x	0	0	0	0	0	0	0	0	8	5	–	–	–	–	–	7	9	9	9	–	–	8	–	–	–	–	–	0	0	8	8
MILESTONE + 2,4-D[2]	x	x	x	x	x	x	x	✓	x	0	0	0	0	0	0	0	0	9	–	–	–	–	–	9	9	9	9	9	9	9	9	–	8	8	8	–	–	–	9	9

[1] For seed crops only.

[2] Various formulations available, see Table 4–1, *Herbicides Used in Ontario*, page 30. See label for specific uses and rates.

[3] Do not use on sweet clover.

[4] On established legumes, use fall spot treatment only.

[5] CLOVITOX PLUS and TOPSIDE not for established clovers.

[6] SIMADEX not for established alfalfa.

TABLE 10–2. Herbicide Treatment Rates for Forages

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS **For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.**

FORAGE GRASSES (SEED PRODUCTION ONLY)

Herbicide Treatments include:

- **Preplant (PP)** – Also see Chapter 6 *Preplant & Postharvest Weed Control*, page 91 for details of products, rates and remarks.
- **Preplant Incorporated (PPI)** – Two incorporations at right angles operating at a depth of 10 cm using a double disk (7–10 km/h) or vibrating shank S-tine cultivator (10–13 km/h) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Special attention should be directed toward machinery cleanliness, and/or treating fields with perennial weeds last.
- **Preemergence (PRE)**
- **Postemergence (POST)** – Leaf stage of the weeds is critical for good weed control. Smaller weeds are usually more sensitive to herbicide injury. Apply according to labelled leaf stages on the pesticide label. Crop stage is important to optimize crop safety. Adjuvants will frequently improve the weed control when used as directed. Weather or other conditions may influence the optimum rate of adjuvant, see the product label for more details. Always use appropriate drift management technology.

Apply all treatments in 100–200 L/ha (40–80 L/acre) water except where otherwise noted.

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS
Postemergence Grass Herbicides			
tralkoxydim (0.2 kg/ha) + adjuvant (0.5% v/v)	ACHIEVE LIQUID (400 g/L) + TURBOCHARGE BISON (400 g/L) + ADDIT ADJUVANT	0.5 L/ha (0.2 L/acre) + 0.5 L/100 L (0.5 L/100 L)	· Apply to wild oats, volunteer oats, green foxtail and yellow foxtail prior to tillering. Applications made to weeds that have tillered may result in unacceptable control. · **For the following forage grasses grown for seed only:** Seedling and established intermediate and crested wheatgrass, creeping red fescue, meadow and smooth bromegrass either underseeded to cereals or grown alone. · For establishment of northern wheatgrass, western wheatgrass and slender wheatgrass. · **Do NOT** tank mix ACHIEVE liquid with any other herbicides, insecticides, fungicides, fertilizers, micronutrients or adjuvants other than those listed on the label.
Postemergence Broadleaf Herbicides			
bentazon (0.84–1.08 kg/ha) + oil concentrate (1–2 L/ha)	BASAGRAN (480 g/L) + ASSIST	1.75–2.25 L/ha (0.7–0.9 L/acre) + 1–2 L/ha (0.4–0.8 L/acre)	· For seed production **ONLY**. · Apply from the 1–7 leaf stage of bromegrass, creeping red fescue, meadow foxtail, orchardgrass, timothy and crested wheatgrass. · Top growth of nutsedge and Canada thistle are controlled and field bindweed may be suppressed by 2 applications of 1.75 L/ha (0.7 L/acre), 10 days apart. · Cool weather or drought may reduce control. · Reduce rate of oil concentrate to 1 L/ha (0.4 L/acre) under abnormally hot and humid weather conditions or temporary crop injury may occur.
pyrasulfotole/bromoxynil (213 kg/ha)	INFINITY	0.83 L/ha (0.33 L/acre)	· For use **ONLY** on timothy grown for seed production. · Apply postemergence and prior to flag leaf emergence. · The addition of ammonium sulphate at 1 L/ha (0.4 L/acre) is required for the control of cleavers at the 4–6 whorl growth stage.

TABLE 10–2. Herbicide Treatment Rates for Forages (cont'd)

FORAGE LEGUMES (DIRECT SEEDED)

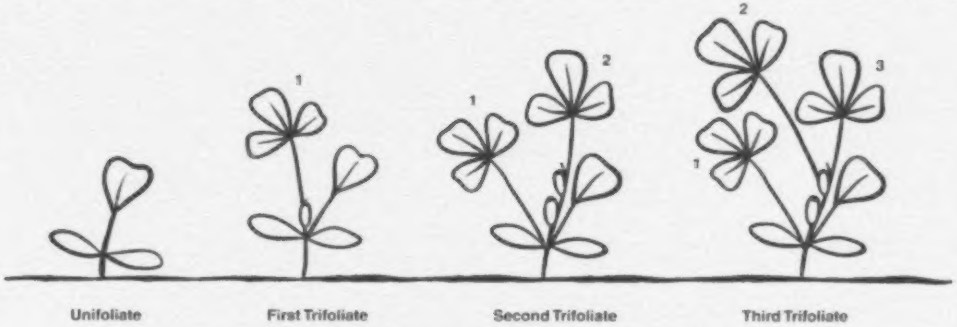

FIGURE 10–1. Stages of Alfalfa Leaf Development.

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Soil Applied Grass Herbicides			
EPTC (3.4 kg/ha)	EPTAM (800 g/L)	4.25 L/ha (1.7 L/acre)	· Apply PPI. · For pure stands of alfalfa or bird's-foot trefoil **ONLY**. · Apply to a dry soil surface and incorporate into the soil immediately. · Some broadleaf weeds such as ragweed, mustards, and pigweeds frequently escape.
trifluralin (0.6–1.148 kg/ha)	TREFLAN (480 g/L)	1.25–2.4 L/ha (0.5–0.96 L/acre)	· Apply PPI. · For pure stands of alfalfa **ONLY**. · Use lower rate on sandy soils, higher rate for loam to clay soils.
	RIVAL (500 g/L)	1.2–2.3 L/ha (0.48–0.92 L/acre)	
	BONANZA 480 (480 g/L)	1.25–2.4 L/ha (0.5–0.96 L/acre)	
Postemergence Grass Herbicides			
sethoxydim (0.15–0.2 kg/ha) + oil concentrate (2 L/ha)	POAST ULTRA (450 g/L) + ASSIST	0.32–0.47 L/ha (0.13–0.19 L/acre) + 2 L/ha (0.8 L/acre)	· Apply POAST ULTRA to emerged annual grasses in the 1–6 leaf stage during active growth while the crop is small enough to permit thorough spray coverage. · Alfalfa is tolerant to POAST ULTRA at any stage of growth. · Use MERGE for conditions or weeds requiring medium to high rates of POAST ULTRA. · Complete control is normally obtained 7–21 days after application. · Allow 70 days between spraying and harvest.
sethoxydim (0.15–0.2 kg/ha) + surfactant/solvent (1 L/ha)	POAST ULTRA (450 g/L) + MERGE	0.32–0.47 L/ha (0.13–0.19 L/acre) + 1 L/ha (0.4 L/acre)	
sethoxydim (0.5 kg/ha) + surfactant/solvent (1–2 L/ha)	POAST ULTRA (450 g/L) + MERGE	1.1 L/ha (0.45 L/acre) + 1–2 L/ha (0.4–0.8 L/acre)	· Apply at the 1–3 leaf stage of actively growing quackgrass. · Thorough preplant tillage will give more uniform quackgrass emergence. · Gives 6–8 weeks control of quackgrass. · Allow 70 days between spraying and harvest.

TABLE 10–2. Herbicide Treatment Rates for Forages (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
FORAGE LEGUMES (DIRECT SEEDED) (CONT'D)			
Postemergence Grass Herbicides (cont'd)			
clethodim (0.03–0.09 kg/ha) + surfactant (0.5% v/v)	SELECT (240 g/L) + AMIGO ARROW (240 g/L) + X-ACT ADJUVANT	0.13–0.38 L/ha (0.05–0.15 L/acre) 5–10 L/1,000 L (5–10 L/1,000 L)	· Apply when the annual grasses and volunteer cereals are in the 2–6 leaf stage. · For pure stands of alfalfa **ONLY**. · Alfalfa is tolerant at any growth stage. · Use the higher rate for control of quackgrass. · Allow 30 days between application and harvest.
fluazifop-p-butyl (0.1–0.25 kg/ha)	VENTURE L (125 g/L)	0.8–2 L/ha (0.32–0.8 L/acre)	· Use the higher rate (2 L/ha (0.8 L/acre)) when quackgrass is present. · Apply at 2–4 leaf stage of annual grasses and at 3–5 leaf stage of quackgrass. · VENTURE L may be tank-mixed with 2,4-DB at label rates for control of a broad range of weeds. (Consult 2,4-DB label). · **Do NOT** feed alfalfa to livestock within 41 days of treatment. · **Do NOT** feed or graze red clover or bird's-foot trefoil in the year of treatment.
Postemergence Broadleaf Herbicides			
bentazon (0.84–1.08 kg/ha) + oil concentrate (1–2 L/ha)	BASAGRAN (480 g/L) + ASSIST	1.75–2.25 L/ha (0.7–0.9 L/acre) 1–2 L/ha (0.4–0.8 L/acre)	· For alfalfa, red clover, alsike clover and sainfoin seed production **ONLY**. · Apply after third trifoliate stage. · Top growth of nutsedge and Canada thistle are controlled and field bindweed may be suppressed by 2 applications of 1.75 L/ha (0.7 L/acre), 10 days apart. · Cool weather or drought may reduce control. · Reduce rate of oil concentrate to 1 L/ha (0.4 L/acre) under abnormally hot and humid weather conditions or temporary crop injury may occur.
2,4-DB (1.1–1.4 kg/ha)	EMBUTOX (625 g/L) CALIBER 625 (625 g/L) COBUTOX 625 (625 g/L)	1.75–2.25 L/ha (0.7–0.9 L/acre)	· Apply in at least 150 L/ha (60 L/acre) water, when alfalfa, bird's-foot trefoil or clovers are in the 1–4 leaf stage and seedling forage grasses are at the 2–4 leaf stage. · **Do NOT** graze or cut legumes for hay within 30 days of treatment. · **NOT** intended for grass forage crops grown for hay or grazing in the year of application. · **Do NOT** apply to crops grown for seed. · **Do NOT** apply under drought conditions. · 2,4-DB usually suppresses legume growth for a period of 2–3 weeks. · Severe injury to legumes may occur under drought, high temperature or other stress conditions.
MCPB/MCPA (15:1) (1.1–1.7 kg/ha)	CLOVITOX PLUS (400 g/L) TROPOTOX PLUS (400 g/L) TOPSIDE (400 g/L)	2.75–4.25 L/ha (1.1–1.7 L/acre)	· Apply when clovers are at the unifoliate to the 4th trifoliate leaf stage and seedling forage grasses are at the 2–4 leaf stage. · Clovers may be suppressed for 2–3 weeks. · **Do NOT** exceed 3.5 L/ha of TOPSIDE for seedling forage grasses. · **Do NOT** apply TOPSIDE and TROPOTOX PLUS in less than 150 L/ha (60 L/acre) of water. · **Do NOT** apply CLOVITOX PLUS in less than 175 L/ha (70 L/ha) of water. · **Do NOT** apply CLOVITOX PLUS when temperatures exceed 27°C. · **Do NOT** apply under drought conditions. · **Do NOT** graze or cut for forage in the year of application.

TABLE 10–2. Herbicide Treatment Rates for Forages (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
FORAGE LEGUMES (DIRECT SEEDED) (cont'd)			
Postemergence Tank-Mixes			
2,4-DB (0.8 kg/ha) + MCPA (35 g/ha)	EMBUTOX (625 g/L) + MCPA AMINE (500 g/L)	1.25 L/ha (0.5 L/acre) + 70 mL/ha (28 mL/acre)	· Apply when the legumes are in the 1–4 leaf stage. · **Do NOT** graze or cut for hay within 30 days of treatment. · **Do NOT** apply to crops grown for seed. · The addition of MCPA gives better control of common mustard than 2,4-DB alone. · Apply in at least 150 L/ha (60 L/acre) water.
	CALIBER 625 (625 g/L) + MCPA AMINE (500 g/L)		
	COBUTOX 625 (625 g/L) + MCPA AMINE (500 g/L)		
Postemergence Grass and Broadleaf Herbicides			
imazethapyr (0.075–0.1 kg/ha) + non ionic surfactant (0.25% v/v) + liquid fertilizer (2 L/ha)	PURSUIT (240 g/L) + non-ionic surfactant + liquid fertilizer (10-34-0, 28-0-0 or 32-0-0)	0.312–0.42 L/ha (0.126–0.168 L/acre) + 2.5 L/1,000 L + 2 L/ha (0.8 L/acre)	· Apply **ONLY** after the crop has one fully developed trifoliate leaf. · For seed alfalfa **ONLY**. · One application per year. Apply when weeds are less than 7.5 cm tall. · Apply in 200 L/ha (80 L/acre) water.
	PHANTOM (240 g/L) + non-ionic surfactant + liquid fertilizer (10-34-0, 28-0-0 or 32-0-0)		
	NU-IMAGE (240 g/L) + non-ionic surfactant + liquid fertilizer (10-34-0, 28-0-0 or 32-0-0)		

TABLE 10–2. Herbicide Treatment Rates for Forages (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
FORAGE LEGUMES (ESTABLISHED)			
Postemergence Grass Herbicides			
quizalofop-p-ethyl (0.036–0.072 kg/ha) + oil concentrate (0.5% v/v)	ASSURE II (96 g/L) + SURE-MIX YUMA GL (96 g/L) + XA OIL CONCENTRATE	0.375–0.75 L/ha (0.15–0.3 L/acre) + 5 L/1,000 L	· Apply to emerged annual grasses and volunteer cereals in the 2 leaf to tillering stage and to quackgrass in the 2–6 leaf stage of growth. · For seed alfalfa **ONLY**. · **Do NOT** graze or cut for hay in the year of treatment. · Use the 0.375 L/ha rate (0.15 L/acre) for control of volunteer corn, volunteer cereals and green foxtail. · The 0.5 L/ha (0.2 L/acre) rate provides suppression of quackgrass and will also control barnyard grass. · Use the 0.75 L/ha (0.3 L/acre) rate for control of quackgrass.
propyzamide (1.125–1.625 kg/ha)	KERB (50 WP)	2.25–3.25 kg/ha (0.9–1.3 kg/acre)	· For grass control **ONLY** in alfalfa and bird's-foot trefoil. · Apply in late September to early November before the soil freezes. · **Do NOT** graze or harvest treated forage within 90 days for the high rate and 60 days for lower rates.
sethoxydim (0.5 kg/ha) + surfactant/solvent (1–2 L/ha)	POAST ULTRA (450 g/L) + MERGE	1.1 L/ha (0.45 L/acre) + 1–2 L/ha (0.4–0.8 L/acre)	· Apply at the 1–3 leaf stage of actively growing quackgrass. · Apply in 110–200 L/ha (44–80 L/acre) water. · Quackgrass control will be provided for 6–8 weeks. · Allow 70 days between spraying and harvest.
fluazifop-p-butyl (0.075–0.25 kg/ha)	VENTURE L (125 g/L)	0.6–2 L/ha (0.24–0.8 L/acre)	· Use the higher rate (2 L/ha (0.8 L/acre)) when quackgrass is present. · Apply at 2–4 leaf stage of annual grasses and at 3–5 leaf stage quackgrass. · VENTURE L may be tank-mixed with 2,4-DB at label rates for control of a broad range of weeds. (Consult 2,4-DB label). · Alfalfa may be fed to livestock 41 days after treatment. · **Do NOT feed red clover or bird's-foot trefoil to livestock in the year of treatment.**
Postemergence Broadleaf Herbicides			
bentazon (0.84–1.08 kg/ha) + oil concentrate (1–2 L/ha)	BASAGRAN (480 g/L) + ASSIST	1.75–2.25 L/ha (0.7–0.9 L/acre) + 1–2 L/ha (0.4–0.8 L/acre)	· For alfalfa, red clover, alsike clover and sainfoin seed production **ONLY**. · Apply when prior to alfalfa flowering and before the canopy closes. · Apply after clovers and sainfoin are 7.5 cm tall and before canopy closes. · Top growth of nutsedge and Canada thistle are controlled and field bindweed may be suppressed by 2 applications of 1.75 L/ha (0.7 L/acre), 10 days apart. · Cool weather or drought may reduce control. · Reduce rate of oil concentrate to 1 L/ha (0.4 L/acre) under abnormally hot and humid weather conditions or temporary crop injury may occur.
2,4-DB (1.4–1.7 kg/ha)	EMBUTOX (625 g/L) CALIBER 625 (625 g/L) COBUTOX 625 (625 g/L)	2.25–2.75 L/ha (0.9–1.1 L/acre)	· Apply after cutting or grazing when alfalfa is dormant and is less than 7.5 cm high. · **Do NOT** apply to established alfalfa that is actively growing or crop injury may occur. · Apply after cutting or grazing when alfalfa is dormant and is less than 7.5 cm high. · **Do NOT** graze or cut for hay within 30 days of treatment. · **Do NOT** apply to crops grown for seed. · Apply in at least 150 L/ha (60 L/acre) water.

TABLE 10–2. Herbicide Treatment Rates for Forages (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
FORAGE LEGUMES (ESTABLISHED) (cont'd)			
Postemergence Broadleaf Herbicides (cont'd)			
MCPB/MCPA (15:1) (1.7 kg/ha)	TOPSIDE (400 g/L)	4.25 L/ha (1.7 L/acre)	· For pure stands or mixtures containing red and alsike clovers **ONLY**. · Apply as spot treatment, or when regrowth after cutting or grazing when weeds are at a susceptible stage.
	CLOVITOX PLUS (400 g/L)		
	TROPOTOX PLUS (400g/L)		
Postemergence Grass and Broadleaf Herbicides			
glyphosate (1.71–4.32 kg/ha)	glyphosate (360 g/L)*	4.75–12 L/ha (1.7–4.8 L/acre)	· **SPOT TREATMENT ONLY:** Apply when field bindweed has reached full bloom and other weeds are in the bud to full bloom stage. · **Do NOT** graze or harvest forage from treated spots until the treated plants turn brown. * See Table 4-1. Herbicides Used in Ontario, page 30, for formulations available. See label for specific uses and rates.
	glyphosate (450 g/L)*	3.8–9.6 L/ha (1.52–3.84 L/acre)	
	glyphosate (480 g/L)*	3.56–9 L/ha (1.42–3.6 L/acre)	
	glyphosate (500 g/L)*	3.42–8.64 L/ha (1.38–3.5 L/acre)	
	glyphosate (540 g/L)*	3.17–8 L/ha (1.27–3.2 L/acre)	
paraquat (0.56–1.1 kg/ha)	GRAMOXONE (200 g/L)	2.8–5.5 L/ha (1.12–2.2 L/acre)	· Apply to trefoil seed fields when the crop is about 15 cm high in the spring. · Apply to alfalfa or trefoil forage fields within 5 days after cutting. · Slow recovery and stand reduction has been observed under conditions of drought or high temperatures. · **Do NOT** use in the spring after treatment with simazine.
imazethapyr (0.075–0.1 kg/ha) + N.I.S. + liquid fertilizer (0.25% v/v, 2 L/ha)	PURSUIT (240 g/L) + non-ionic surfactant + liquid fertilizer (10-34-0, 28-0-0 or 32-0-0)	0.312–0.42 L/ha (0.126–0.168 L/acre) + 2.5 L/1,000 L + 2 L/ha (0.8 L/acre)	· Apply **ONLY** after the crop has one fully developed trifoliate leaf. · For seed alfalfa **ONLY**. · One application per year. Apply when weeds are less than 7.5 cm tall. · Apply in 200 L/ha (80 L/acre) water.
	PHANTOM (240 g/L) + non-ionic surfactant + liquid fertilizer (10-34-0, 28-0-0 or 32-0-0)		
	NU-IMAGE (240 g/L) + non-ionic surfactant + liquid fertilizer (10-34-0, 28-0-0 or 32-0-0)		
simazine (1.1 kg/ha)	SIMADEX (500 g/L)	2.2 L/ha (0.88 L/acre)	· Apply in September to November before freeze up. · This treatment prevents legume seedlings from establishing for approximately 8 months. · **Do NOT** use SIMADEX on alfalfa. · **Do NOT** use in the fall before seeding another crop. · **Do NOT** apply GRAMOXONE within 1 year after simazine application. · **Do NOT** apply to the same field for more than 3 consecutive years. · Allow 30 days between applications and grazing of cattle or sheep.
	PRINCEP NINE-T (90 WG)	1.22 kg/ha (0.49 kg/acre)	
	SIMAZINE 80W (80 WP)	1.38 kg/ha (0.55 kg/acre)	

TABLE 10–2. Herbicide Treatment Rates for Forages (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4. Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
FORAGE LEGUMES (ESTABLISHED) (cont'd)			
Preharvest			
glyphosate (0.9–1.8 kg/ha)	glyphosate (360 g/L)*	2.5–5 L/ha (1–2 L/acre)	· Apply 3–7 days prior to last cut in the final year of the forage. Forage can be harvested as hay, haylage or grazed. * See Table 4–1. Herbicides Used in Ontario, page 30, for formulations available. See label for specific uses and rates.
	glyphosate (450 g/L)*	2–4 L/ha (0.8–1.6 L/acre)	
	glyphosate (480 g/L)*	1.875–3.75 L/ha (0.75–1.5 L/acre)	
	glyphosate (500 g/L)*	1.8–3.6 L/ha (0.73–1.46 L/acre)	
	glyphosate (540 g/L)*	1.67–3.34 L/ha (0.67–1.34 L/acre)	
FORAGE SORGHUM AND FORAGE MILLET			
Postemergence Broadleaf Herbicides			
2,4-D (0.28–0.56 kg/ha)	2,4-D AMINE (470 g/L)*	0.6–1.2 L/ha (0.24–0.48 L/acre)	· Apply when crop is at 4–6 leaf stage before closure of canopy. · **Do NOT** apply within 30 days of harvest. · **Do NOT** spray in hot (over 27°C), humid weather. * See Table 4–1. Herbicides Used in Ontario, page 30, for formulations available. See label for specific uses and rates.
bentazon (0.84–1.08 kg/ha)	BASAGRAN FORTÉ (480 g/L)	1.75–2.25 L/ha (0.7–0.9 L/acre)	· Apply when crop is at 3–6 leaf stage before closure of canopy. · **Do NOT** apply within 30 days of harvest. · Hot, humid weather may result in temporary leaf yellowing.
bromoxynil (0.28 kg/ha)	PARDNER (280 g/L)	1 L/ha (0.4 L/acre)	· Apply post in 200–300 L/ha of water. · Apply when the crop has more than 4 leaves, but before it is 20 cm tall. · Apply **ONLY** 1 application per year. · **Do NOT** harvest within 30 days of application. * See Table 4–1. Herbicides Used in Ontario, page 30, for formulations available. See label for specific uses and rates.
	BROMOXYNIL (240 g/L)*	1.2 L/ha (0.48 L/acre)	
	BROMOXYNIL (480 g/L)*	0.6 L/ha (0.24 L/acre)	
prosulfuron + dicamba (10 g/ha + 0.14 kg/ha) + non-ionic surfactant (0.2% v/v) or crop oil concentrate (1% v/v)	PEAK (75 WG) + BANVEL II (480 g/L) + ASSIST	13.3 g/ha (5.3 g/acre) + 0.3 L/ha (0.12 L/acre) + 10 L/1,000 L	· Apply when the crop is between 3–5 leaf stage. · Best results when applied to actively growing weeds in the 1–6 leaf stage. · **Do NOT** apply by air. · Make **ONLY** 1 application per year.

TABLE 10–2. Herbicide Treatment Rates for Forages (cont'd)

PASTURE RENOVATION WITH BIRD'S-FOOT TREFOIL

The introduction of this legume into a pasture requires control of competition from weeds and forage grasses for the first 2–4 months after the legume seed begins to germinate. Control of established perennial weeds should start at least one year before the legume seeding operation. Treatments in Chapter 6 of this publication could be used. If the field cannot be plowed and worked to prepare a seedbed, one of the following chemical treatments can be used to suppress the sod.

The success of these programs depends on many management factors such as inoculation of the trefoil seed as well as control of fertility and grazing.

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Postemergence Grass and Broadleaf Herbicides			
glyphosate (1.71–4.32 kg/ha)	glyphosate (360 g/L)*	4.75–12 L/ha (1.9–4.8 L/acre)	• Apply when the forage grasses have at least 2 leaves.
	glyphosate (450 g/L)*	3.8–9.6 L/ha (1.52–3.84 L/acre)	* See Table 4–1, Herbicides Used in Ontario, page 30, for formulations available. See label for specific uses and rates.
	glyphosate (480 g/L)*	3.56–9 L/ha (1.42–3.6 L/acre)	
	glyphosate (500 g/L)*	3.42–8.64 L/ha (1.37–3.46 L/acre)	
	glyphosate (540 g/L)*	3.17–8 L/ha (1.27–3.2 L/acre)	
paraquat (1.1 kg/ha)	GRAMOXONE (200 g/L)	5.5 L/ha (2.2 L/acre)	• Broadcast seed and fertilizer in mid-April. • Apply GRAMOXONE in early May when the grass is 5–10 cm high before the legume seed germinates.

TABLE 10–2. Herbicide Treatment Rates for Forages (cont'd)

PASTURES (MOSTLY GRASSES)

Biennials: Unless otherwise noted, most chemicals are best applied in early fall to first year growth or in late spring to second year growth.

Perennials: Unless otherwise noted, apply in late spring (end of May to mid-June) when weeds are actively growing. Overgrazing tends to thin the grass stand and allows the establishment of weeds. Undergrazing allows weeds like wild carrot to establish and spread seed. Timely mowing can reduce the amount of weed seeds produced.

- Chemicals are available to control most of the troublesome weeds in grass pastures and these can give faster kill of established weeds than any other management practice. A chemical may have to be applied more than once to kill established perennial weeds and the new crop of weeds that emerges through a thin grass stand. A poor grass stand can be improved by using a combination of chemicals, fertility and grazing management.
- Extend chemical weed control into fencerows and other areas around the pasture to keep these areas from becoming sources of weed seeds.
- Generally, clovers are severely damaged by chemical treatments. However, white clover and black medic show some resistance and re-establish quickly.
- Consult the label to determine the period of time to keep livestock out of the treated area.
- Prevent grazing where poisonous plants (water hemlock, buttercup, chokecherry, etc.) may be made more attractive to livestock after the chemical treatment. It is a good practice to prevent grazing on the field for at least a week after spraying to reduce the chances of the livestock consuming harmful plants.
- Apply chemical treatments in at least 200 L/ha (80 L/acre) water and increase this rate if it is necessary to contact weeds through dense vegetation.
- Avoid drift or vapour drift from 2,4-D or dicamba onto susceptible crops by using drift reducing techniques such as high spray volume, coarse droplets or anti-drift nozzles.

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
2,4-D (0.85–1.1 kg/ha)	2,4-D (470 g/L)*	1.8–2.34 L/ha (0.72–0.94 L/acre)	· **Use the low rate for chicory.** · **Use the high rate for:** **Goldenrod.** **Yellow rocket:** Mow before spraying if plants are in flowering stage. **Blueweed and burdock:** Apply as low volatile ester. **Wild carrot:** Early spring or early fall. If 2,4-D resistant strains are present, mow to reduce seed spread. **Goat's-beard:** Early spring or early fall. **Milkweed:** Spray undersides of leaves. Only top growth is killed. **Water hemlock:** Apply in May or June. **Dandelion:** Can also apply in September. * See Table 4–1. Herbicides Used in Ontario, page 30, for formulations available. See label for specific uses and rates.
	2,4-D (564 g/L)*	1.5–1.95 L/ha (0.6–0.78 L/acre)	
	2,4-D (660 g/L)*	1.29–1.67 L/ha (0.52–0.67 L/acre)	
2,4-D (1.1–1.75 kg/ha)	2,4-D (470 g/L)*	2.34–3.72 L/ha (0.94–1.49 L/acre)	· **For ox-eye daisy and hawk's-beard:** Use 2 treatments, one in late spring and the second in early September if there is sufficient growth. * See Table 4–1. Herbicides Used in Ontario, page 30, for formulations available. See label for specific uses and rates.
	2,4-D (564 g/L)*	1.95–3.1 L/ha (0.6–1.24 L/acre)	
	2,4-D (660 g/L)*	1.29–2.65 L/ha (0.52–1.06 L/acre)	
2,4-D (2.25 kg/ha)	2,4-D (470 g/L)*	4.5 L/ha (1.8 L/acre)	· **For tansy ragwort.** Apply to rosettes in spring or fall. · Retreat as necessary to control new seedlings and regrowth. * See Table 4–1. Herbicides Used in Ontario, page 30, for formulations available. See label for specific uses and rates.
	2,4-D (564 g/L)*	3.99 L/ha (1.6 L/acre)	
	2,4-D (660 g/L)*	3.40 L/ha (1.36 L/acre)	

TABLE 10–2. Herbicide Treatment Rates for Forages (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
PASTURES (MOSTLY GRASSES) (CONT'D)			
2,4-D (1.1 kg/ha) + dicamba (1.01 kg/ha)	2,4-D (470 g/L)* + BANVEL II (480 g/L)	2.34 L/ha (0.94 L/acre) + 2.1 L/ha (0.84 L/acre)	· **For wild carrot:** Apply in early fall for control of first year plants. · Wait 14 days between treatment and harvest or grazing for dairy animals. · Meat animals may graze or feed in treated pastures 30 days after dicamba application without restrictions on slaughter. · If treated vegetation has been consumed by meat animals within 30 days of dicamba application, feed the animals with untreated diet for 30 days before slaughter.
	2,4-D (470 g/L)* + ORACLE (480 g/L)		
	2,4-D (470 g/L)* + HAWKEYE (480 g/L)		
	2,4-D (564 g/L)* + BANVEL II (480 g/L)	1.95 L/ha (0.6 L/acre) + 2.1 L/ha (0.84 L/acre)	* See Table 4–1. Herbicides Used in Ontario, page 30, for formulations available. See label for specific uses and rates.
	2,4-D (564 g/L)* + ORACLE (480 g/L)		
	2,4-D (564 g/L)* + HAWKEYE (480 g/L)		
	2,4-D (660 g/L)* + BANVEL II (480 g/L)	1.29 L/ha (0.52 L/acre) + 2.1 L/ha (0.84 L/acre)	
	2,4-D (660 g/L)* + ORACLE (480 g/L)		
	2,4-D (660 g/L)* + HAWKEYE (480 g/L)		
amitrole (0.038–0.106 kg/10 L)	AMITROL 240 (231 g/L)	0.165–0.46 L/10 L	· **SPOT TREATMENT ONLY.** · **Lower rate for dandelion, Canada thistle, perennial sow-thistle, hoary cress, milkweed, poison-ivy, and toadflax.** · Higher rate for horsetail and leafy spurge. · Spray to wet before flowering. · Keep animals away from treated area for 6–8 months.
dicamba (0.6 kg/ha)	BANVEL II (480 g/L)	1.25 L/ha (0.5 L/acre)	· **FOR ALL RATES OF DICAMBA:** Meat animals may graze or feed treated pastures 30 days after dicamba application without restrictions on slaughter. If treated vegetation has been consumed by meat animals within 30 days of dicamba application, feed the animals with untreated diet for 30 days before slaughter. · **For leafy and cypress spurges:** for control of top growth, apply when weed is actively growing. · No delay is required between treatment and harvest or grazing for dairy animals.
	ORACLE (480 g/L)		
	HAWKEYE (480 g/L)		
dicamba (1.01 kg/ha)	BANVEL II (480 g/L)	2.1 L/ha (0.84 L/acre)	· **For tansy ragwort:** Apply when weed is actively growing. · Wait 7 days between treatment and harvest or grazing for dairy animals. · Meat animals may graze or feed treated pastures 30 days after dicamba application without restrictions on slaughter.
	ORACLE (480 g/L)		
	HAWKEYE (480 g/L)		

TABLE 10–2. Herbicide Treatment Rates for Forages (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
PASTURES (MOSTLY GRASSES) (CONT'D)			
dicamba (1.1 kg/ha)	BANVEL II (480 g/L) ORACLE (480 g/L) HAWKEYE (480 g/L)	2.29 L/ha (0.92 L/acre)	· **For goldenrod:** Apply when weed is actively growing. · Wait 14 days between treatment and harvest or grazing for dairy animals. · Meat animals may graze or feed treated pastures 30 days after dicamba application without restrictions on slaughter.
dicamba (1.2 kg/ha)	BANVEL II (480 g/L) ORACLE (480 g/L) HAWKEYE (480 g/L)	2.5 L/ha (1 L/acre)	· **For Canada thistle and field bindweed:** Apply at bud stage of thistle and at flowering of bindweed. · Wait 14 days between treatment and harvest or grazing for dairy animals. · Meat animals may graze or feed treated pastures 30 days after dicamba application without restrictions on slaughter.
dicamba (2.212 kg/ha)	BANVEL II (480 g/L) ORACLE (480 g/L) HAWKEYE (480 g/L)	4.6 L/ha (1.84 L/acre)	· **For goat's beard:** Apply when actively growing. · Wait 14 days between treatment and harvest or grazing for dairy animals. · Meat animals may graze or feed treated pastures 30 days after dicamba application without restrictions on slaughter.
2,4-DB (1.72 kg/ha)	EMBUTOX (625 g/L) CALIBER 625 (625 g/L) COBUTOX 625 (625 g/L)	2.75 L/ha (1.1 L/acre)	· **Nodding, Scotch, or bull thistles, perennial sow-thistle, and chicory:** Apply to rosette stage. · **Yellow rocket:** Apply in fall. · **Plantains:** Apply before flowering. · **Curled dock:** Apply to early growth. · Top growth only controlled for: **Canada thistle:** Apply when 15 cm high to early bud stage. **Field bindweed:** Apply in late summer. **Dandelion:** Apply before bud stage. **Horsetail:** Apply at 10–12 cm tall. · **Do NOT** graze or cut for forage in the year of treatment.
MCPB/MCPA (1.7 kg/ha)	CLOVITOX PLUS (400 g/L) TROPOTOX PLUS (400 g/L) TOPSIDE (400 g/L)	4.25 L/ha (1.7 L/acre)	· Controls top growth of weeds only. · **Canada thistle:** Apply when 15 cm high to early bud stage. · **Curled dock, plantains and perennial sow-thistle:** Apply to rosette stage. · **Buttercup and field bindweed:** Apply in spring. · **Horsetail:** Apply when 15 cm high. · This treatment has some safety on legumes. · Apply TOPSIDE after grazing or cutting when weeds are at a susceptible stage. · **Do NOT** apply TOPSIDE and TROPOTOX PLUS in less than 150 L/ha (60 L/acre) of water. · **Do NOT** apply CLOVITOX PLUS in less than 175 L/ha (70 L/acre) of water. · **Do NOT** apply CLOVITOX PLUS when temperatures exceed 27°C. · **For CLOVITOX PLUS and TOPSIDE:Do NOT** apply under drought conditions. · **Do NOT** graze or harvest for forage in the year of application.

TABLE 10–2. Herbicide Treatment Rates for Forages (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
PASTURES (MOSTLY GRASSES) (CONT'D)			
glyphosate (1.71–4.32 kg/ha)	glyphosate (360 g/L)*	4.75–12 L/ha (1.9–4.8 L/acre)	· **SPOT TREATMENT ONLY:** · **For Canada thistle, field bindweed and milkweed.** · Always use high rate for milkweed. · Apply when thistle and milkweed are in the bud to full bloom stage and bindweed is flowering. · **For colt's-foot:** Apply when leaves are fully expanded. · **For tansy ragwort:** Apply when tansy is in bud to full bloom stage. · Wait until the treated areas have turned brown before grazing. * See Table 4–1. Herbicides Used in Ontario, page 30, for formulations available. See label for specific uses and rates.
	glyphosate (450 g/L)*	3.8–8 L/ha (1.52–3.2 L/acre)	
	glyphosate (480 g/L)*	3.56–9 L/ha (1.42–3.6 L/acre)	
	glyphosate (500 g/L)*	3.42–8.64 L/ha (1.37–3.46 L/acre)	
	glyphosate (540 g/L)*	3.17–8 L/ha (1.27–3.2 L/acre)	
MCPA (1.1 kg/ha)	MCPA (500 g/L)*	2.2 L/ha (0.88 L/acre)	· **For buttercup:** Use 2 treatments, one in June and the second in early September. · Wait 7 days after treatment before grazing. * See Table 4–1. Herbicides Used in Ontario, page 30, for formulations available. See label for specific uses and rates.
aminopyralid (60–120 g/ha)	MILESTONE (240 g/L)	0.25–0.5 L/ha (0.10–0.20 L/acre)	· Apply Postemergence. · **Will control:** absinth (biennial) wormwood, goldenrod, knapweed, scentless chamomile, Canada thistle, yellow star thistle, musk (nodding) thistle, sulphur cinquefoil, tropical soda apple and tansy ragwort. · **Will suppress:** Common tansy and dandelion. · **Do NOT** move manure compost containing MILESTONE onto sensitive crops, flowers, gardens, etc., or injury may occur.
aminopyralid (60–120 g/ha) + 2,4-D AMINE (840–1,440 g/ha)	MILESTONE (240 g/L) + 2,4-D AMINE (564 g/L)*	0.25–0.5 L/ha (0.10–0.20 L/acre) + 1.49–2.55 L/ha (0.596–1.02 L/acre)	· Apply Postemergence. · For wider spectrum of weed control, 2,4-D AMINE may be added at a ratio of 1 part Milestone ai/ha to 12 parts 2,4-D AMINE ai/ha. · **Do NOT** move manure compost containing MILESTONE onto sensitive crops, flowers, gardens, etc., or injury may occur. * See Table 4–1. Herbicides Used in Ontario, page 30, for formulations available. See label for specific uses and rates.

11. SOYBEANS

NOTES: Weed control ratings are given as 0–9 where 0 indicates no control and 9 indicates 90%–100% control under ideal conditions. Ratings are subjective values based on best available information and give general comparisons based on use as described in this guide. Under unfavourable conditions (e.g., too dry, too wet, too cold or poor application) the herbicides may not be as effective as indicated. Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used. Always refer to the product label for more information on registered weed species, product uses and precautions.

TABLE 11–1. Conventional Soybean Herbicide Weed Control Ratings

LEGEND: Numbers (0–9) = weed control ratings
* = sold as a co-pack under this trade name
R = populations resistant to this herbicide exist in Ontario and won't be adequately controlled if present

Crop tolerance ratings: E = Excellent, G = Good, F = Fair, P = Poor

– = insufficient information available to make a rating

	Grasses								Annual Broadleaves											Perennials							
Trade Name	barnyard grass	crabgrass	fall panicum	foxtail, giant	foxtail, green	foxtail, yellow	witchgrass	proso millet	buckwheat, wild	cocklebur	fleabane, Canada	lady's thumb	lamb's-quarters	mustards	nightshades, annual	pigweeds	ragweed, common	ragweed, giant	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada	Crop Tolerance
Preplant Burndown Herbicides – Refer to Table 11–4. Soybean Herbicide Weed Control Ratings in Glyphosate Tolerant Soybeans, page 219 for a list of herbicides and weed control ratings.																											
Soil Applied Grass Herbicides																											
DUAL II MAGNUM	9	9	8	8	9	9	9	4	2	2	0	2	7	2	8[2]	8[2]	4	3	2	0	0	0	8[1]	0	0	0	G
FRONTIER MAX	9	9	8	8	9	9	9	4	2	2	0	2	7	2	8[2]	8[2]	4	3	2	0	0	0	8[1]	0	0	0	G
PROWL H2O	9	9	9	8	8	8	–	5	–	–	–	–	7	–	–	8	–	–	–	–	–	–	–	–	–	–	E
TREFLAN or BONANZA or RIVAL	9	9	8	9	9	9	9	6	5	2	0	2	8	2	2	8	2	1	2	2	2	2	2	2	2	2	G
Soil Applied Broadleaf Herbicides																											
AUTHORITY	–	–	–	–	–	–	–	–	9	–	–	–	9	–	9	9	4	–	–	–	–	–	–	–	–	–	E
BROADSTRIKE RC	0	0	0	0	5	0	0	0	–	7^R	8^R	8	9^R	8	7^R	9^R	8^R	7^R	9	–	8	–	–	–	–	–	E
FIRSTRATE	0	0	0	0	0	0	0	0	–	9^R	9^R	–	9^R	–	2	9^R	9^R	9^R	9	–	2	–	–	2	6	–	E
LOROX	5	5	5	5	5	5	5	5	8	5	5	9	9	9	9	9^R	8	6	6	2	2	2	2	2	2	2	G
PERFECTA*	7	6	7	5	5	5	8	3	9	9	8	9	9	9	9	9	8	7	7	2	2	2	2	2	2	2	G
SENCOR	7	6	7	5	5	5	8	3	7	7	9[2]	9	9^R	9^R	3	9^R	8^R	7	7	2	2	2	2	2	2	2	G
STEP UP*	3	3	3	5	5	5	3	–	9	9	8	9	9	9	9	9	8	7	7	2	2	2	2	2	2	2	G

[1] PPI timing and the highest labeled rate is required to achieve this level of control.

[2] Use the high rate of herbicide for optimum control.

TABLE 11–1. Conventional Soybean Herbicide Weed Control Ratings (cont'd)

LEGEND: Numbers (0–9) = weed control ratings
* = sold as a co-pack under this trade name
R = populations resistant to this herbicide exist in Ontario and won't be adequately controlled if present

Crop tolerance ratings: E = Excellent, G = Good, F = Fair, P = Poor

– = insufficient information available to make a rating

	Grasses								Annual Broadleaves											Perennials							
Trade Name	**barnyard grass**	**crabgrass**	**fall panicum**	**foxtail, giant**	**foxtail, green**	**foxtail, yellow**	**witchgrass**	**proso millet**	**buckwheat, wild**	**cocklebur**	**fleabane, Canada**	**lady's thumb**	**lamb's-quarters**	**mustards**	**nightshades, annual**	**pigweeds**	**ragweed, common**	**ragweed, giant**	**velvetleaf**	**bindweed, field**	**horsetail**	**milkweed**	**nutsedge**	**quackgrass**	**sow-thistle**	**thistle, Canada**	**Crop Tolerance**
VALTERA	3	3	3	5	5	5	3	–	–	4	8	7	9	–	9	9	7	3	7	–	–	–	–	–	–	–	G
Soil Applied Grass and Broadleaf Herbicides																											
BOUNDARY LQD	9	9	8	8	9	9	9	4	–	–	–	–	7	–	8[2]	8[2]	–	–	–	–	–	–	8[1]	–	–	–	E
CANOPY PRO*	7	6	7	5	5	5	8	3	8	7^R	8^R	9	9^R	9	3	9^R	8^R	8^R	8	2	2	2	8	2	2	2	G
COMMAND 360 ME	9	9	–	–	9	9	–	–	–	–	–	–	9	–	9	6	8/9	–	9	–	–	–	–	–	–	–	E
CONQUEST*	8	7	7	9	9	9	8	7	8	8	2	9	9^R	9	9^R	9^R	9	6	9	2	2	2	7	6	2	2	G
FIERCE	9	9	–	9	9	9	–	–	8	5	8	8	9	9	9	9	7	5	7	–	–	–	–	–	–	–	G
FREESTYLE*	8	7	7	9^R	9^R	9	8	7	8	7^R	8^R	9	9^R	9	9^R	9^R	8^R	8^R	9	2	2	2	8	6	2	2	E
OPTILL	8	7	7	9^R	9^R	9	8	7	8	7	9	9	9^R	9	9^R	9^R	8^R	7	9	6	7	–	7	6	2	2	E
PURSUIT or PHANTOM or NU-IMAGE	8	7	7	9^R	9^R	9	8	7	8	7^R	2	9	9^R	9	9^R	9^R	8^R	6	9	2	2	2	7	6	2	2	E
TRIACTOR*	8	7	7	9	9	9	8	7	8	8	2	9	9	9	9	9	9	6	9	2	2	2	7	6	2	2	G
Soil Applied Tank-Mixes																											
BROADSTRIKE RC + DUAL II MAGNUM	9	9	8	8	9	9	9	6	7	7	9^R	9	9^R	9	9	9	8^R	7	9	2	8	–	8[1]	0	3	4	E
BROADSTRIKE RC + TREFLAN	9	9	8	9	9	9	9	6	5	4	8^R	8	9	8	7	9	8^R	7	9	2	2	2	2	2	2	2	E
COMMAND 360 ME + SENCOR	9	9	–	–	9	9	–	–	–	–	–	–	9	–	9	9	9	–	9	–	–	–	–	–	–	–	G
COMMAND 360 ME + LOROX	9	9	–	–	9	9	–	–	–	–	–	–	9	–	9	9	9	–	9	–	–	–	–	–	–	–	G
COMMAND 360 ME + PURSUIT	9	9	7	9	9	9	8	7	8	7	–	9	9	9	9	9	8/9	6	9	–	–	–	7	–	–	–	E
COMMAND 360 ME + DUAL II MAGNUM	9	9	8	9	9	9	9	4	–	–	–	–	9	–	9	8/9	8/9	–	9	–	–	–	8	–	–	–	E
DUAL + LOROX + SENCOR	9	9	8	8	9	9	9	5	8	7	5	9	9	9	8	9	8	7	7	2	2	2	7	2	2	2	G
DUAL II MAGNUM + LOROX	9	9	8	8	9	9	9	5	8	5	5	9	9	9	8	9	8	6	6	2	2	2	7	2	2	2	G
DUAL II MAGNUM + SENCOR	9	9	8	8	9	9	9	5	7	7	5	9	9	9	8[2]	9	8	7	7	2	2	2	7	2	2	2	G
DUAL II MAGNUM+ PURSUIT	9	9	8	8	9	9	9	7	8	7	–	9	9	9	9[2]	9	8	6	9	2	2	2	7	6	2	2	G

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[1] PPI timing and the highest labeled rate is required to achieve this level of control.

[2] Use the high rate of herbicide for optimum control.

TABLE 11–1. Conventional Soybean Herbicide Weed Control Ratings (cont'd)

LEGEND: Numbers (0–9) = weed control ratings Crop tolerance ratings: E = Excellent, G = Good, F = Fair, P = Poor – = insufficient information available to make a rating
* = sold as a co-pack under this trade name
R = populations resistant to this herbicide exist in Ontario and won't be adequately controlled if present

	Grasses								**Annual Broadleaves**											**Perennials**							
Trade Name	**barnyard grass**	**crabgrass**	**fall panicum**	**foxtail, giant**	**foxtail, green**	**foxtail, yellow**	**witchgrass**	**proso millet**	**buckwheat, wild**	**cocklebur**	**fleabane, Canada**	**lady's thumb**	**lamb's-quarters**	**mustards**	**nightshades, annual**	**pigweeds**	**ragweed, common**	**ragweed, giant**	**velvetleaf**	**bindweed, field**	**horsetail**	**milkweed**	**nutsedge**	**quackgrass**	**sow-thistle**	**thistle, Canada**	**Crop Tolerance**
FRONTIER MAX + SENCOR	9	9	8	8	9	9	9	5	7	7	5	9	9^R	9^R	8[2]	9	8^R	7	7	2	2	2	8[1]	2	2	2	G
Soil Applied Tank-Mixes (cont'd)																											
FRONTIER MAX + PURSUIT	9	9	8	9	9	9	9	7	8	7^R	–	9	9^R	9	9	9	8^R	6	9	2	2	2	7	6	2	2	G
PURSUIT + FIRSTRATE	8	7	7	9^R	9^R	9	8	7	8	9^R	9^R	9	9^R	9	9^R	9^R	9^R	9	9	2	2	2	7	6	2	2	E
PURSUIT + PROWL H20	9	9	9	9	9	9	8	7	8	7^R	2	9	9	9	9^R	9^R	8^R	6	9	2	2	2	7	6	2	2	G
(PURSUIT **or** PHANTOM **or** NU-IMAGE) + LOROX	8	7	7	9^R	9^R	9	8	7	8	7	5	9	9	9	9	9	8	6	9	2	2	2	7	6	2	2	G
(PURSUIT **or** PHANTOM **or** NU-IMAGE) + SENCOR	8	7	7	9^R	9^R	9	8	5	8	7	5	9	9^R	9	9^R	9^R	8	7	9	2	2	2	7	6	2	2	G
(PURSUIT **or** PHANTOM **or** NU-IMAGE) + (TREFLAN **or** BONANZA **or** RIVAL)	9	9	8	9	9	9	9	7	8	7^R	–	9	9^R	9	9	9^R	8^R	6	9	2	2	2	7	6	2	2	G
(TREFLAN **or** BONANZA **or** RIVAL) + SENCOR	9	9	8	9	9	9	9	6	7	7	5	9	9	9	3	9	8	7	8	2	2	2	2	2	2	2	G
Postemergence Grass Herbicides																											
ASSURE II/YUMA GL	9	8	9	9	9	9	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0	E
EXCEL SUPER	9	8	9	9	9	9	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	E
POAST ULTRA	9	8	9	9	9	9	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	E
SELECT	9	8	9	9	9	9	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	E
VENTURE L	9	8	9	8	8	9	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0	E
Postemergent Broadleaf Herbicides																											
BASAGRAN FORTÉ	0	0	0	0	0	0	0	0	7	9	5	9	7	9	7	7	8	6	9	5	2	2	8	0	5	7	G
BLAZER	0	0	0	0	0	0	0	0	7	6	2	8	7	9	8	9	9	7	7	7	6	5	2	2	6	6	F
CLASSIC/CHAPERONE	0	0	0	0	0	0	0	0	4	8^R	8^R	8	3	9	3	9^R	8^R	8^R	8	2	2	8	8	2	8	4	G
FIRSTRATE	0	0	0	0	0	0	0	0	7	9^R	9^R	–	2	9	2	2	9^R	9^R	9	–	2	–	–	2	7	7	E
PINNACLE SG	0	0	0	0	0	0	0	0	–	5	2	8	9^R	8	3	9^R	5	2	8	2	2	2	2	2	2	2	G

[1] PPI timing and the highest labeled rate is required to achieve this level of control.
[2] Use the high rate of herbicide for optimum control.

TABLE 11–1. Conventional Soybean Herbicide Weed Control Ratings (cont'd)

LEGEND: Numbers (0–9) = weed control ratings — Crop tolerance ratings: E = Excellent, G = Good, F = Fair, P = Poor — – = insufficient information available to make a rating
* = sold as a co-pack under this trade name
R = populations resistant to this herbicide exist in Ontario and won't be adequately controlled if present

	Grasses								**Annual Broadleaves**											**Perennials**							
Trade Name	**barnyard grass**	**crabgrass**	**fall panicum**	**foxtail, giant**	**foxtail, green**	**foxtail, yellow**	**witchgrass**	**proso millet**	**buckwheat, wild**	**cocklebur**	**fleabane, Canada**	**lady's thumb**	**lamb's-quarters**	**mustards**	**nightshades, annual**	**pigweeds**	**ragweed, common**	**ragweed, giant**	**velvetleaf**	**bindweed, field**	**horsetail**	**milkweed**	**nutsedge**	**quackgrass**	**sow-thistle**	**thistle, Canada**	**Crop Tolerance**
REFLEX	0	0	0	0	0	0	0	0	8	7	2	8	6	9	8	9	9	7	6	3	6	2	–	0	5	3	G
Postemergence Grass and Broadleaf Herbicides																											
CLEAN SWEEP*	9	8	6	9^{R}	9^{R}	9	9	7	8	9	5	9	8	9	9^{R}	9^{R}	8	6^{R}	9	5	2	2	8	2	5	7	G
PURSUIT or PHANTOM	9	8	6	9^{R}	9^{R}	9	9	7	8	8^{R}	2	9	8^{R}	9	9^{R}	9^{R}	8^{R}	8^{R}	9	2	2	2	7	2	2	2	G
Postemergence Tank-Mixes																											
ASSURE II/YUMA GL + BASAGRAN FORTÉ + PINNACLE SG	9	8	9	9	9	9	9	9	7	9	5	9	9	9	7	9^{R}	8	6	9	6	2	2	8	9	5	7	G
ASSURE II/YUMA GL + PINNACLE SG	9	8	9	9	9	9	9	9	–	5	2	8	9^{R}	8	3	9^{R}	5	2	8	2	2	2	2	9	2	2	G
ASSURE II/YUMA GL + CLASSIC/CHAPERONE	9	8	9	9	9	9	9	9	4	9^{R}	8	8	3	9	3	9^{R}	8^{R}	8^{R}	8	2	2	8	8	9	8	4	G
BLAZER + BASAGRAN FORTÉ	0	0	0	0	0	0	0	0	7	9	5	9	8	9	8	9	9	6	9	7	6	5	8	2	6	7	F
EXCEL SUPER + BASAGRAN FORTÉ	9	8	9	9	9	9	9	9	7	9	5	9	8	9	7	7	8	6	9	6	2	2	8	4	5	7	G
EXCEL SUPER + BASAGRAN FORTÉ + PINNACLE SG	9	8	9	9	9	9	9	9	7	9	5	9	9	9	7	9^{R}	8	6	9	6	2	2	8	4	5	7	G
EXCEL SUPER + PINNACLE SG	9	8	9	9	9	9	9	9	–	5	2	8	9^{R}	8	3	9^{R}	5	2	8	2	2	2	2	4	2	2	G
PINNACLE + BASAGRAN FORTÉ	0	0	0	0	0	0	0	0	7	9	5	9	8	9	7	7	8	6	9	6	2	2	8	1	5	7	G
PINNACLE + REFLEX	0	0	0	0	0	0	0	0	8	7	2	8	9^{R}	9	8	9	9	7	8	–	–	–	–	–	–	–	G
PURSUIT + FIRSTRATE	9	8	6	9^{R}	9^{R}	9	9	7	8	9^{R}	9	9	8^{R}	9	9^{R}	9^{R}	9^{R}	9	9	2	2	–	7	2	7	7	G
PURSUIT + REFLEX	9	8	6	9^{R}	9^{R}	9	9	7	8	8^{R}	2	9	8^{R}	9	9^{R}	9	8	7	9	2	2	2	7	2	2	2	G
REFLEX + VENTURE L	9	8	9	8	8	9	9	9	8	7	2	8	6	9	8	9	9	7	6	3	6	2	–	0	5	3	G
VENTURE L + BASAGRAN	9	8	9	8	8	8	9	8	7	9	5	9	7	9	7	7	8	6	9	6	2	2	8	9	5	7	G

[1] PPI timing and the highest labeled rate is required to achieve this level of control.

[2] Use the high rate of herbicide for optimum control.

TABLE 11–2. Additional Weed Control Ratings in Conventional Soybean

Notes: Weed control ratings are given as 0–9 where 0 indicates no control and 9 indicates 90%–100% control under ideal conditions. Ratings are subjective values based on best available information and give general comparisons based on use as described in this guide. Under unfavourable conditions (e.g., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated. Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used. Always refer to the product label for more information on registered weed species, product uses and precautions.

LEGEND: Numbers (0–9) = weed control ratings * = herbicides sold as a co-pack under this trade name

Weed Species	**Timing**	**Herbicides (control rating – out of 10)**
atriplex, spreading	Preplant	glyphosate + either SENCOR (8/9), BROADSTRIKE RC + DUAL MAGNUM (8), CONQUEST* (8), FIRSTRATE (7), LOROX (8) or PHANTOM/PURSUIT/NU-IMAGE (7), GUARDIAN* (7/8)
	Postemergence	PINNACLE SG (6), CLEANSWEEP* (5), BASAGRAN FORTÉ (4)
adzuki beans, volunteer	Preplant	glyphosate (8), GUARDIAN/* (8)
	Postemergence	CLASSIC/CHAPERONE (7), BLAZER (6), PINNACLE SG (2), BASAGRAN FORTÉ (1), FIRSTRATE (1), REFLEX (1)
beggarsticks, nodding	Preplant	GUARDIAN* (8)
	Preemergence	FIRSTRATE (9), LOROX (9), SENCOR (7), DUAL II MAGNUM (3)
	Postemergence	BASAGRAN FORTÉ (9), CLASSIC/CHAPERONE (9), FIRSTRATE (9), CLEANSWEEP* (9), PINNACLE SG (8), PHANTOM/PURSUIT/NU-IMAGE (7), BLAZER (4), REFLEX (4)
bur-cucumber	Preplant	GUARDIAN* (8)
	Preemergence	SENCOR (4)
	Postemergence	CLASSIC/CHAPERONE (5), PINNACLE SG (3)
corn, volunteer	Postemergence	ASSURE II/YUMA GL (9), VENTURE L (9), EXCEL SUPER (8), POAST ULTRA (7), SELECT (7)
dandelion	Preplant	GUARDIAN* (9), glyphosate[1] (9), GUARDIAN PLUS (8), glyphosate + ERAGON + MERGE[1] (7)
flower of an hour	Preplant	GUARDIAN* (9)
	Postemergence	BASAGRAN FORTÉ (8), CLEANSWEEP (8), FIRSTRATE (8), PINNACLE SG (8), CLASSIC/CHAPERONE (7), PHANTOM/PURSUIT/NU-IMAGE (7), REFLEX (7), BLAZER (6)
horsenettle	Preplant	GUARDIAN* (8), glyphosate[1] + either BROADSTRIKE RC + DUAL MAGNUM (8), FIRSTRATE (8), LOROX (8) or PHANTOM/PURSUIT/NU-IMAGE (8), CONQUEST* (7/8), SENCOR (7/8)
	Postemergence	FIRSTRATE (6)
prickly lettuce	Preplant	glyphosate alone (9), GUARDIAN[1] (8), glyphosate + either FIRSTRATE (9), CONQUEST* (8), PHANTOM/PURSUIT/NU-IMAGE (8), BROADSTRIKE RC + DUAL MAGNUM (7), LOROX (4) or SENCOR (4)
	Postemergence	CLASSIC/CHAPERONE (6), FIRSTRATE (6), REFLEX (6), CLEANSWEEP (2), BLAZER (4), PINNACLE SG (3), BASAGRAN FORTÉ (2), PHANTOM/PURSUIT/NU-IMAGE (2)
sandbur	Preemergence	PHANTOM/PURSUIT/NU-IMAGE (7)
	Postemergence	ASSURE II/YUMA GL (9), VENTURE L (8), EXCEL SUPER (8), POAST ULTRA (7), SELECT (7)
three-seeded mercury	Preplant	GUARDIAN* (8), glyphosate + either FIRSTRATE (9), SENCOR (8), BROADSTRIKE RC + DUAL MAGNUM (8), CONQUEST* (7), LOROX (6) or PHANTOM/PURSUIT/NU-IMAGE (5)
	Preemergence	BROADSTIKE RC + DUAL MAGNUM (8), SENCOR (7), LOROX (5)
	Postemergence	CLASSIC/CHAPERONE (7), FIRSTRATE (7), REFLEX (7), BLAZER (6), CLEANSWEEP (6), PINNACLE SG (5), BASAGRAN FORTÉ (5), PHANTOM/PURSUIT/NU-IMAGE (5)

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[1] Various formulations available, see Table 4–1. *Herbicides Used in Ontario,* page 30.

TABLE 11–2. Additional Weed Control Ratings in Conventional Soybean (cont'd)

Notes: Weed control ratings are given as 0–9 where 0 indicates no control and 9 indicates 90%–100% control under ideal conditions. Ratings are subjective values based on best available information and give general comparisons based on use as described in this guide. Under unfavourable conditions (e.g., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated. Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used. Always refer to the product label for more information on registered weed species, product uses and precautions.

LEGEND: Numbers (0–9) = weed control ratings * = herbicides sold as a co-pack under this trade name

Weed Species	**Timing**	**Herbicides (control rating – out of 10)**
waterhemp	Preplant	GUARDIAN* (9), glyphosate (9)
	Preemergence	DUAL II MAGNUM (6), FRONTIER MAX (6), VALTERA (9)
	Postemergence	REFLEX (9), BLAZER (9), BASAGRAN FORTÉ (2), CLEANSWEEP* (2), PINNACLE SG (2), FIRSTRATE (1), CLASSIC/CHAPERONE (0), PHANTOM/PURSUIT/NU-IMAGE (0)
wild carrot	Preplant	GUARDIAN* (8), glyphosate + either BROADSTRIKE RC + DUAL MAGNUM (8), CONQUEST* (7), PHANTOM/PURSUIT/NU-IMAGE (7), FIRSTRATE (6), SENCOR (5) or LOROX (1)
	Preemergence	BROADSTRIKE RC + DUAL MAGNUM (6), PHANTOM/PURSUIT/NU-IMAGE (5)
	Postemergence	CLASSIC/CHAPERONE (8), FIRSTRATE (6), CLEANSWEEP (5), PHANTOM/PURSUIT/NU-IMAGE (5), BASAGRAN FORTÉ (4), REFLEX (2), BLAZER (2), PINNACLE SG (2)
wirestem muhly	Postemergence	VENTURE L (7), ASSURE II/YUMA GL (6), POAST ULTRA (3), SELECT (3), EXCEL SUPER (2)
wood-sorrel	Preemergence	BROADSTRIKE RC + DUAL MAGNUM (8), LOROX (8), SENCOR (6)
	Postemergence	FIRSTRATE (8), BLAZER (6), CLASSIC/CHAPERONE (5), CLEANSWEEP* (5), PHANTOM/PURSUIT/NU-IMAGE (5), BASAGRAN FORTÉ (4), PINNACLE SG (3)
violet, field	Postemergence	FIRSTRATE (8), BLAZER (6), CLASSIC/CHAPERONE (5), CLEANSWEEP* (5), PHANTOM/PURSUIT/NU-IMAGE (5), BASAGRAN FORTÉ (4), PINNACLE SG (3)

[1] Various formulations available, see Table 4–1. *Herbicides Used in Ontario*, page 30.

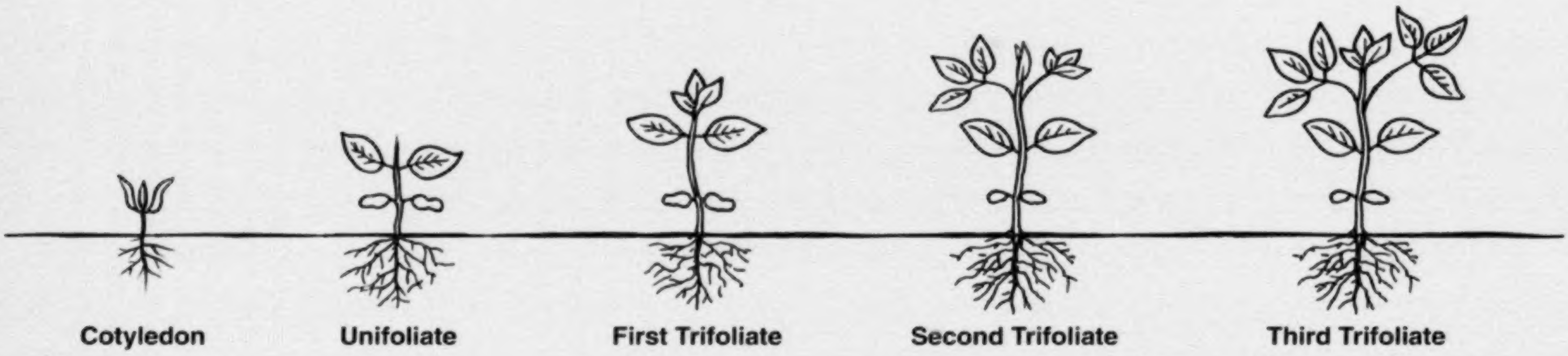


FIGURE 11–1. Soybean Development Stages.

Soybeans

Unless otherwise specified, apply all treatments in 150–300 L/ha (60–120 L/acre) water.

Thoroughly clean all equipment used to apply non soybean herbicides (e.g., ACCENT, LONTREL, MARKSMAN, 2,4-D etc.) immediately after use, as well as before spraying soybeans. See Cleaning the Sprayer, on page 14.

Total Weed Control System – Although herbicides themselves may be effective, there is a benefit to using other methods of weed control. Crop rotation, herbicide rotation, early weed control with a rotary hoe, harrowing, cultivating and preventing the spread of weeds as much as possible are all a part of weed management. See Chapter 9, *Corn (Field, Seed & Sweet)*, on page 127, for details of each of these methods.

Resistant Weeds – Biotypes of a number of weeds have been found resistant to Group 5 (triazine), Group 2 herbicides (e.g., Pursuit) and Group 9 herbicides (e.g., Roundup). Weed species that are resistant to a particular herbicide treatment are identified in the weed control rating tables with a subscript "R", meaning that the identified herbicide treatment will not control a biotype that is resistant but a weed rating without the subscript "R" will, provided the rating indicates a control level of 8 or higher.

Herbicide Treatments include:

- **Preplant (PP)** – See Preplant Chapter 6 *Preplant & Postharvest Weed Control*, page 91, for details of products, rates and remarks.

- **Preplant Incorporated (PPI)** – Two incorporations at right angles operating at a depth of 10 cm using a double disk (7–10 km/h) or vibrating shank S-tine cultivator (10–13 km/h) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Ensure machines are clean and/or treat fields with perennial weeds last.

- **Preemergence (PRE)** – Rainfall of 15–20 mm within 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improves herbicide activity in the absence of rainfall.

- **Postemergence (POST)** – Leaf stage of the weeds is critical for good weed control. Smaller weeds are usually more sensitive to herbicide injury. Apply according to the leaf stage specified on the pesticide label. Crop stage is important to optimize crop safety. Adjuvants will frequently improve the weed control when used as directed. Weather or other conditions may influence the optimum rate of adjuvant, see the product label for more details. Always use appropriate drift management technology.

TABLE 11–3. Herbicide Treatment Rates for Conventional (Non-GMO) Soybean

ACTIVE INGREDIENT (rate)	**TRADE NAME** (Concentration)	**PRODUCT RATE**	**PRECAUTIONS** For more information, see Chapter 4, Herbicides Used in Ontario, page 27, and Chapter 5, Notes on Adjuvants, page 81.
Preplant Burndown Herbicides – For Weed Control Ratings refer to Table 11–5. Soybean Herbicide Weed Control Ratings in Glyphosate Tolerant Soybeans, page 220. Refer also to Chapter 6, Preplant & Postharvest Weed Control, page 91.			
Non-selective herbicides such as glyphosate and GRAMAXONE are used to control emerged weeds prior to no-till planting. Tank-mixing of a residual herbicide with glyphosate or GRAMAXONE can be used to improve application efficiency with a "one pass" weed management program. Refer to Chapter 6, Preplant & Postharvest Weed Control, page 91 for preplant application rates for glyphosate and GRAMAXONE. It is also important to note that when targeting perennial weeds, the addition of a triazine-based herbicide (i.e., SENCOR) will reduce the level of activity achieved with glyphosate. Increasing the rate of glyphosate should overcome this antagonism.			
chlorimuron-ethyl (9 g ai/ha) + metribuzin (412 g/ha) + glyphosate (900 g/ha)	CANOPY PRO (sold as a co-pack): CLASSIC GRANDE (25 DF) + TRICOR 75 DF + glyphosate (360 g/L)*	36 g/ha (14.4 g/acre) + 550 g/ha (220 g/acre) + 2.5 L/ha (1 L/acre)	• Apply PP up to 14 days before planting • Some rotational restrictions apply (see CLASSIC label and Table 4–4. Herbicide Crop Rotation and Soil pH Restrictions: Field Crops, page 74). • **Do NOT** use on sandy soils or on coarse soils with less than 2% organic matter. • Use higher rate of glyphosate for large perennials weeds, refer to Table 6–3. for specific details on page 91. * Numerous products exist, refer to Table 11–7. Glyphosate Products Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant "Roundup Ready" Soybean, page 225 for a complete list of registered products.
saflufenacil (25.2 g/ha) + glyphosate (900 g/ha) + adjuvant (1 L/ha)	ERAGON (70% SG) + glyphosate (360 g/L)* + MERGE	36 g/ha (14.4 g/acre) + 2.5 L/ha (1 L/acre) + 1 L/ha (0.4 L/acre)	• Apply PP **ONLY**, from 21 days prior to planting up to the day of planting. • **Do NOT** use rates higher than 36 g/ha (14.4 g/acre) or crop injury may result. * Numerous products exist, refer to Table 11–7. Glyphosate Products Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant "Roundup Ready" Soybean, page 225 for a complete list of registered products.
	ERAGON LQ (342 g/L) + glyphosate (360 g/L)* + MERGE	73 mL/ha (29.5 mL/acre) + 2.5 L/ha (1 L/acre) + 1 L/ha (0.4 L/acre)	
saflufenacil (25.2 g/ha) + imazethapyr (0.1 kg/ha) + glyphosate (900 g/ha) + adjuvant (1 L/ha)	ERAGON (70% SG) + PURSUIT (240 g/L) + glyphosate (360 g/L)* + MERGE	36 g/ha (14.4 g/acre) + 0.42 L/ha (0.168 L/acre) + 2.5 L/ha (1 L/acre) + 1 L/h a (0.4 L/acre)	• Apply PP **ONLY**, from 21 days prior to planting up to the day of planting. • **Do NOT** use rates higher than 36 g/ha (14.4 g/acre) or crop injury may result. • Refer to precautions for PURSUIT, page 207. * Numerous products exist, refer to Table 11–7. Glyphosate Products Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant "Roundup Ready" Soybean, page 225 for a complete list of registered products.
	ERAGON LQ (342 g/L) + PURSUIT (240 g/L) + glyphosate (360 g/L)* + MERGE	73 mL/ha (29.5 mL/acre) + 0.42 L/ha (0.168 L/acre) + 2.5 L/ha (1 L/acre) + 1 L/ha (0.4 L/acre)	

TABLE 11–3. Herbicide Treatment Rates for Conventional (Non-GMO) Soybean (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more Information, see Chapter 4, Herbicides Used in Ontario page 27, and Chapter 5, Notes on Adjuvants, page 81.
Preplant Burndown Herbicides (cont'd) **For Weed Control Ratings refer to Table 11–5. Soybean Herbicide Weed Control Ratings in Glyphosate Tolerant Soybeans, page 220. Refer also to Chapter 6, Preplant & Post-harvest Weed Control, page 91.**			
chlorimuron-ethyl (9 g ai/ha) + imazethapyr (75 g/ha) + glyphosate (900 g/ha)	FREESTYLE (sold as a co-pack): CLASSIC GRANDE (25 DF) + DUPONT IMAZETHAPYR (240 g/L) + glyphosate (360 g/L)*	36 g/ha (14.4 g/acre) + 312 mL/ha (126 mL/acre) 2.5 L/ha (1 L/acre)	· Apply PP up to 14 days before planting · Some rotational restrictions apply (refer to CLASSIC and PURSUIT in Table 4–4. Herbicide Crop Rotation and Soil pH Restrictions: Field Crops, page 74). * Numerous products exist, refer to Table 11–7. Glyphosate Products Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant "Roundup Ready" Soybean, page 225 for a complete list of registered products.
glyphosate (0.9 kg/ha) + chlorimuron-ethyl (9 g/ha)	GUARDIAN (sold as a co-pack): POLARIS (360 g/L) + CLASSIC (25 DF)	2.5 L/ha (1 L/acre) 36 g/ha (14 g/acre)	· Apply as a PP burndown. · Some rotational restrictions apply (see CLASSIC label and Table 4–4. Herbicide Crop Rotation and Soil pH Restrictions: Field Crops, page 74). · GUARDIAN is a co-pack of POLARIS + CLASSIC. · Some GUARDIAN co-pack's may contain TOUCHDOWN TOTAL instead of POLARIS. If you have a co-pack that contains TOUCHDOWN TOTAL, it should be applied at a rate of 1.8 L/ha (0.72 L/acre).
chlorimuron-ethyl (5.14%)/flumioxazin (40.6%) (80.5 g/ha) + glyphosate (0.9 kg/ha)	GUARDIAN PLUS II (sold as a co-pack): GUARDIAN PLUS WDG + POLARIS (360 g/L)	176 g/ha (70.4 g/acre) 2.5 L/ha (1 L/acre)	· Apply as a PP burndown. · Some rotational restrictions apply (see CLASSIC label and Table 4–4. Herbicide Crop Rotation and Soil pH Restrictions: Field Crops, page 74). · Refer to precautionary statements for VALTERA. · GUARDIAN PLUS is a co-pack of POLARIS + GUARDIAN PLUS WDG.
saflufenacil/ dimethenamid-P (247 g/ha) + glyphosate (900 g/ha)	INTEGRITY (668 g/L) + glyphosate (360 g/L)* + MERGE	0.37 L/ha (0.15 L/acre) + 2.5 L/ha (1 L/acre) + 1 L/ha (0.4 L/acre)	· Apply PP **ONLY**. · **Do NOT** use rates higher than 0.15 L/acre, as crop injury may result. * Numerous products exist, refer to Table 11–7. Glyphosate Products Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant "Roundup Ready" Soybean, page 225 for a complete list of registered products.
saflufenacil/imazethapyr (100 g/ha) + glyphosate (900 g/ha)	OPTILL (68%) + glyphosate (360 g/L)* + MERGE	147 g/ha (60 g/acre) + 2.5 L/ha (1 L/acre) + 1 L/ha (0.4 L/acre)	· Apply PP **ONLY**, from 21 days prior to planting up to the day of planting. · Provides early-season weed control. Refer to glyphosate label for recommended rate. * Numerous products exist, refer to Table 11–7. Glyphosate Products Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant "Roundup Ready" Soybean, page 225 for a complete list of registered products.

TABLE 11–3. Herbicide Treatment Rates for Conventional (Non-GMO) Soybean (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario page 27, and Chapter 5, Notes on Adjuvants, page 81.
Preplant Burndown Herbicides (cont'd) **For Weed Control Ratings refer to Table 11–5. Soybean Herbicide Weed Control Ratings in Glyphosate Tolerant Soybeans, page 220. Refer also to Chapter 6, Preplant & Post-harvest Weed Control, page 91**			
flumioxazin (95.8 g/ha) + metribuzin (416 g/ha) + glyphosate (900 g/ha)	PERFECTA (sold as a co-pack): VALTERA (51.1%) + TRICOR (75%) + glyphosate (360 g/L)*	 187.5 g/ha (75 g/acre) + 555 g/ha (220 g/acre) + 2.5 L/ha (1 L/acre)	· Apply PP or PRE but no longer than 3 days after planting. Applications made to soybeans that have begun to crack or are emerged will result in severe crop injury · The risk of crop injury is minimized when Valtera is used on well drained soils and planted to a depth of 4 cm or more · When using no-till planters with coulters that incorporate the soil, weed control may be reduced, therefore applications should be done after planting, but within 3 days of planting. * Numerous products exist, refer to Table 11–7. Glyphosate Products Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant "Roundup Ready" Soybean, page 225 for a complete list of registered products.
pendimethalin (1,000 g/ha) + glyphosate (900 g/ha)	PROWL H20 (455 g/L) + glyphosate (360 g/L)*	2.2 L/ha (0.89 L/acre) + 2.5 L/ha (1 L/acre)	· Apply PP. · Provides early-season weed control only. * Numerous products exist, refer to Table 11–7. Glyphosate Products Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant "Roundup Ready" Soybean, page 225 for a complete list of registered products.
flumioxazin (95.8 g/ha) + chlorimuron-ethyl (9 g/ha) + glyphosate (900 g/ha)	STEP-UP (sold as a co-pack): VALTERA (51.1%) + CHAPERONE (25%) + glyphosate (360 g/L)*	 187.5 g/ha (75 g/acre) + 36 g/ha (14.4 g/acre) + 2.5 L/ha (1 L/acre)	· Apply PP or PRE but no longer than 3 days after planting. Applications made to soybeans that have begun to crack or are emerged will result in severe crop injury · The risk of crop injury is minimized when Valtera is used on well drained soils and planted to a depth of 4 cm or more · When using no-till planters with coulters that incorporate the soil, weed control may be reduced, therefore applications should be done after planting, but within 3 days of planting. * Numerous products exist, refer to Table 11–7. Glyphosate Products Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant "Roundup Ready" Soybean, page 225 for a complete list of registered products.

TABLE 11–3. Herbicide Treatment Rates for Conventional (Non-GMO) Soybean (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario page 27, and Chapter 5, Notes on Adjuvants, page 81.
Soil Applied Grass Herbicides			
s-metolachlor/benoxacor (1.05–1.6 kg/ha)	DUAL II MAGNUM (915 g/L)	1.15–1.75 L/ha (0.46–0.7 L/acre)	• Apply PP, PPI or PRE. • Can be used for weed control in EDAMAME. Can be tank-mixed with glyphosate or GRAMOXONE for PP burndown of emerged annual and perennial weeds, see Chapter 6, Preplant & Postharvest Weed Control, page 91 for more information. • Control of yellow nutsedge is obtained when DUAL II MAGNUM is applied PPI. • Optimal control of nightshade is obtained when DUAL II MAGNUM is applied PRE. • **Do NOT** use on muck, peat or high organic matter soils. • Use the higher rate of (DUAL II MAGNUM) for heavier weed populations. • Incorporation depth should not exceed 10 cm.
carfentrazone-ethyl (8.76–21.6 g/ha) + pyroxasulfone (100–150 g/ha)	FOCUS (sold as a co-pack): AIM EC (240g/L) + PYROXASULFONE (85 WG)	36.5–90 mL/ha (15–36 mL/acre) + 118–178 g/ha (48–72 g/acre)	• Apply PP or PRE. • **Do NOT** use on peat or muck soils and soils with 7% or more organic matter content. • Moisture is necessary to activate the active ingredient pyroxasulfone in soil for weed control. • The AIM EC component will only control emerged broadleaf weeds at application.
dimethenamid (544–693 g/ha)	FRONTIER MAX (720 g/L)	756–963 mL/ha (305–390 mL/acre)	• Apply PP, PPI or PRE. • For PPI applications, the minimum rate is 860 mL/ha (348 mL/acre) and should be cultivated into the top 5 cm of soil within 7 days of planting. • Can be tank-mixed with glyphosate or GRAMOXONE for PP burndown of emerged annual and perennial weeds, see Chapter 6, Preplant & Postharvest Weed Control, page 91 for more information. • Use higher rate for heavier weed pressure, for the control of nightshade and pigweed. (PPI or PRE only) or on fine textured or high organic matter soils. • Control of nutsedge is achieved by applying FRONTIER PPI at the highest rate. • Soybeans should be seeded at least 4 cm deep or crop injury may result.
trifluralin (0.6–1.155 kg/ha)	TREFLAN (480 g/L)	1.25–2.4 L/ha (0.5–0.96 L/acre)	• Apply PPI. • Conduct first incorporation as soon as possible after application, may be delayed up to 8–24 hours. A second incorporation should occur anytime before planting.
	RIVAL (500 g/L)	1.2–2.3 L/ha (0.48–0.92 L/acre)	
	BONANZA 480 (480 g/L)	1.25–2.4 L/ha (0.5–0.96 L/acre)	

TABLE 11–3. Herbicide Treatment Rates for Conventional (Non-GMO) Soybean (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario page 27, and Chapter 5, Notes on Adjuvants, page 81.
Soil Applied Broadleaf Herbicides			
sulfentrazone (105 – 140 g/ha)	AUTHORITY (480 g/L)	219 – 292 mL/ha (88 – 117 mL/acre)	· Apply PP or PRE but no later than 3 days after planting. · Some rotational cropping restrictions apply (see Table 4–4. Herbicide Crop Rotation and Soil pH Restrictions: Field Crops, page 74). · **Do NOT** apply to flax grown on coarse-textured (sandy) soils. · **Do NOT** apply to soils with organic matter greater than 6%. · **Do NOT** apply to soils with a pH greater than 7.8. · The highest use rate should be used when applied to soils with a pH of less than 7 and with organic matter greater than 3% but less than 6%.
flumetsulam (70 g/ha)	BROADSTRIKE RC (80%)	87.5 g/ha (35 g/acre)	· Apply PP, PPI or PRE. For PPI treatments uniformly incorporate with equipment set to work at a depth of 5–8 cm. · Can be applied up to 21 days before planting in minimum or no-tillage systems. · Can be tank-mixed with glyphosate for PP burndown of emerged annual and perennial weeds, see Chapter 6, Preplant & Postharvest Weed Control, page 91 for more information. · **Do NOT** apply to areas where the soil pH is greater than 7.8 and organic matter is less than 2%. · **Do NOT** apply to soils containing more than 5% organic matter. · Sufficient rainfall to moisten the soil to a depth of 5 cm should be received within 7–10 days for optimum weed control. · Some rotational cropping restrictions apply (see Table 4–4. Herbicide Crop Rotation and Soil pH Restrictions: Field Crops, page 74).
cloransulam-methyl (35 g/ha)	FIRSTRATE (84 WG)	41.7 g/ha (17 g/acre)	· Apply PRE. · Apply in both conventional and conservation tillage systems. · Some rotational cropping restrictions apply (see Table 4–4. Herbicide Crop Rotation and Soil pH Restrictions: Field Crops, page 74).
linuron (1.13–2.25 kg/ha)	LOROX L (480 g/L)	2.25–4.5 L/ha (0.9–1.8 L/acre)	· Apply PRE. · **Do NOT** use on sands (less than 2% organic matter). · Plant soybeans at least 4 cm deep. · Heavy rainfall and adverse weather conditions may result in temporary crop injury. · Use higher rate for muck soils and clay soils.

TABLE 11–3. Herbicide Treatment Rates for Conventional (Non-GMO) Soybean (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario page 27, and Chapter 5, Notes on Adjuvants, page 81.
Soil Applied Broadleaf Herbicides (cont'd)			
metribuzin (0.56–1.12 kg/ha)	SENCOR 75 DF (75 WG)	0.75–1.5 kg/ha (0.3–0.6 kg/acre)	· Apply PP, PPI or PRE. · Can be tank-mixed with glyphosate or GRAMOXONE for PP burndown of emerged annual and perennial weeds, see Chapter 6, Preplant & Postharvest Weed Control, page 91 for more information. · **Do NOT** use on sandy or coarse soils with less than 2% organic matter. · Use the label rate for each soil types (see label), otherwise crop injury may occur. · Excessive rainfall and adverse weather conditions may result in crop injury. · Plant soybeans at least 4 cm deep. · For preplant applications: – Apply up to 30 days prior to seeding the crop. – Use the higher rate when weeds are dense and are on soils with high organic matter (over 4%) and on soils with high clay content. – If emerged weeds are taller than 4 cm, apply in tank-mix with glyphosate. · Some rotational cropping restrictions apply (see Table 4–4. Herbicide Crop Rotation and Soil pH Restrictions: Field Crops, page 74).
flumioxazin (71.4–107.1 g/ha)	VALTERA (51.1%)	140–210 g/ha (56–84 g/acre)	· Apply to coarse and medium textured soils. · Can be tank-mixed with glyphosate for PP burndown of emerged annual and perennial weeds, see Chapter 6, Preplant & Postharvest Weed Control, page 91 for more information. · Apply to soybeans prior to planting or within 3 days after planting but prior to soybean emergence. · Severe crop injury will result if applications are made to soybeans that have begun to crack through the soil surface or have emerged. · **Do NOT** apply within 100 metres of non-dormant pears. · **Do NOT** tank-mix with DUAL II MAGNUM, BOUNDARY LQD or FRONTIER MAX. · Any tillage operation performed after application will reduce weed control. · Apply only **ONCE** per growing season.
Soil Applied Grass and Broadleaf Herbicides			
s-metolachlor/metribuzin (1,443 g/ha–1943 g/ha)	BOUNDARY LQD (628 g/L + 149 g/L)	1.85–2.5 L/ha (0.74–1 L/acre)	· Apply PP or PRE. · **Do NOT** apply if soybeans have emerged. · **Do NOT** apply to coarse textured soils with less than 1% organic matter. · Can be tank-mixed with glyphosate or GRAMOXONE for PP burndown of emerged annual and perennial weeds, see Chapter 6, Preplant & Postharvest Weed Control, page 91 for more information.

TABLE 11–3. Herbicide Treatment Rates for Conventional (Non-GMO) Soybean (cont'd)

ACTIVE INGREDIENT (rate)	**TRADE NAME (Concentration)**	**PRODUCT RATE**	**PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario page 27, and Chapter 5, Notes on Adjuvants, page 81.**
Soil Applied Grass and Broadleaf Herbicides (cont'd)			
clomazone (0.576–0.846 kg/ha)	COMMAND 360 ME (360 g/L)	1.6–2.35 L/ha (0.64–0.94 L/acre)	· **Do NOT** use on natto soybeans. · Apply PRE. · **Do NOT** incorporate. · For light textured soils – apply COMMAND at 1.6 L/ha (0.64 L/acre). · For medium textured soils – apply COMMAND at 2.3 L/ha (0.92 L/acre). · For heavy textured soils – apply COMMAND at 2.35 L/ha (0.94 L/acre). · Control of yellow foxtail is achieved when COMMAND is applied at 2.3–2.35 L/ha (0.92 - 0.94 L/acre). · Some rotational cropping restrictions apply (see Table 4–4. Herbicide Crop Rotation and Soil pH Restrictions: Field Crops, page 74).
imazethapyr (0.075–0.1 kg/ha) + metribuzin (0.425–0.542 kg/ha)	CONQUEST LQ (sold as a co-pack): (PURSUIT (240 g/L) + SENCOR 480 F (480 g/L))	0.312–0.42 L/ha (0.126–0.168 L/acre) + 0.815–1.14 L/ha (0.33–0.46 L/acre)	· Apply PPI or PRE. · Can be tank-mixed with glyphosate for PP burndown of emerged annual and perennial weeds, see Chapter 6, Preplant & Postharvest Weed Control, page 91 for more information. · For use on medium and heavy textured soils only. · Use higher rates for heavier weed pressure, for fine textured soils or soils high in organic matter. · See PURSUIT, on page 207 for additional comments.
flumioxazin/pyroxasulfone (159.6 g/ha)	FIERCE (76%)	210 g/ha (85 g/acre)	· Apply PP or PRE but no longer than 3 days after planting. Applications made to soybeans that have begun to crack or are emerged will result in severe crop injury · The risk of crop injury is minimized when used on well drained soils and planted to a depth of 4 cm or more · When using no-till planters with coulters that incorporate the soil, weed control may be reduced, therefore applications should be done after planting, but within 3 days of planting. · Do not use FIERCE herbicide in soybeans in the same field that BOUNDARY, DUAL II MAGNUM or FRONTIER MAX will be used preemergee, or soybean injury may occur.
chlorimuron-ethyl (9 g ai/ha) + imazethapyr (75 g/ha) + glyphosate (900 g/ha)	FREESTYLE (sold as a co-pack); CLASSIC GRANDE (25 DF) + DUPONT IMAZETHAPYR (240 g/L) + glyphosate (360 g/L)*	36 g/ha (14.4 g/acre) + 312 mL/ha (126 mL/acre) + 2.5 L/ha (1 L/acre)	· Apply as a Pre-Plant or PRE. · Some rotational restrictions apply (refer to CLASSIC and PURSUIT in Table 4–4. Herbicide Crop Rotation and Soil pH Restrictions: Field Crops, page 74). · Can be tank-mixed with glyphosate or GRAMOXONE for PP burndown of emerged annual and perennial weeds, see Chapter 6, Preplant & Postharvest Weed Control, page 91 for more information. * Numerous products exist, refer to Table 11–7. Glyphosate Products Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant "Roundup Ready" Soybean, page 225 for a complete list of registered products.

TABLE 11–3. Herbicide Treatment Rates for Conventional (Non-GMO) Soybean (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario page 27, and Chapter 5, Notes on Adjuvants, page 81.
Soil Applied Grass and Broadleaf Herbicides (cont'd)			
imazethapyr (0.075–0.1 kg/ha)	PURSUIT (240 g/L)	0.312–0.42 L/ha (0.126–0.168 L/acre)	• Apply PP, PPI or PRE. • Can be tank-mixed with glyphosate or GRAMOXONE for PP burndown of emerged annual and perennial weeds, see Chapter 6, Preplant & Postharvest Weed Control, page 91 for more information. • Some rotational cropping restrictions apply (see Table 4–4. Herbicide Crop Rotation and Soil pH Restrictions: Field Crops, page 74). • Addition of non-ionic surfactant and liquid fertilizer is required if emerged weeds are present at application. • For preplant applications: – apply PURSUIT at 0.168 L/acre. – apply up to 30 days prior to planting. – for minimum tillage, only 1 working of the soil to prepare a seedbed is suggested following application. Make this final seedbed preparation no deeper than 10 cm and do not turn untreated soil to the surface. • For preplant incorporated applications apply PURSUIT at 0.126 L/acre. • For preemergence applications, heavy infestations of ragweed and/or barnyard grass require a tank-mix. • For preplant incorporated applications, heavy infestations of lamb's-quarters, ragweed or barnyard grass may require a tank-mix. • **Do NOT** apply as preplant incorporated application more than 1 year in sequence. • Use only **ONCE** per season.
	PHANTOM (240 g/L)		
	NU-IMAGE (240 g/L)		
flumioxazin (95.8 g/ha) + metribuzin (413 g/ha) + imazethapyr (76.8 g/ha)	TRIACTOR (sold as a co-pack): VALTERA (51.1%) + TRICOR (75%) + NU-IMAGE (240 g/L)	187.5 g/ha (75 g/acre) + 550 g/ha (220 g/acre) + 320 mL/ha (128 mL/acre)	• Apply PP or PRE but no longer than 3 days after planting. Applications made to planted soybeans where the soil has begun to crack or where beans are emerged will result in severe crop injury. • The risk of crop injury is minimized when VALTERA is used on well drained soils and planted to a depth of 4 cm or more. • When using no-till planters with coulters that incorporate the soil, weed control may be reduced, therefore applications should be done after planting, but within 3 days of planting.

TABLE 11–3. Herbicide Treatment Rates for Conventional (Non-GMO) Soybean (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario page 27, and Chapter 5, Notes on Adjuvants, page 81.
Soil Applied Tank-Mix Options			
flumetsulam (70 g/ha) + s-metolachlor/benoxacor (1.05–1.6 kg/ha)	BROADSTRIKE RC (80%) + DUAL II MAGNUM (915 g/L)	87.5 g/ha (35 g/acre) + 1.15–1.75 L/ha (0.46–0.7 L/acre)	• Apply PP, PPI or PRE. For PPI treatments uniformly incorporate with equipment set to work at a depth of 5–8 cm. • Can be applied up to 21 days before planting in minimum or no-tillage systems. • Can be tank-mixed with glyphosate for PP burndown of emerged annual and perennial weeds, see Chapter 6, Preplant & Postharvest Weed Control, page 91 for more information. • **Do NOT** apply to areas where the soil pH is greater than 7.8 and organic matter less than 2%. • **Do NOT** apply to soils containing more than 5% organic matter. • Sufficient rainfall to moisten the soil to a depth of 5 cm should be received within 7–10 days for optimum weed control. • Some rotational cropping restrictions apply (see Table 4–4. Herbicide Crop Rotation and Soil pH Restrictions: Field Crops, page 74).
flumetsulam (70 g/ha) + trifluralin (0.6–1.155 kg/ha)	BROADSTRIKE RC (80%) + TREFLAN (480 g/L)	87.5 g/ha (35 g/acre) 1.25–2.4 L/ha (0.5–0.96 L/acre)	• Apply PPI, uniformly incorporate with equipment set to work at a depth of 5–8 cm. • Must be incorporated within 24 hours of application. • Can be applied up to 21 days before planting. • **Do NOT** apply to areas where the soil pH is greater than 7.8 and organic matter is less than 2%. • **Do NOT** apply to soils containing more than 5% organic matter. • Sufficient rainfall to moisten the soil to a depth of 5 cm should be received within 7–10 days for optimum weed control. • Some rotational cropping restrictions apply (see Table 4–4. Herbicide Crop Rotation and Soil pH Restrictions: Field Crops, page 74).
clomazone (0.576–0.846 kg/ha) + s-metolachlor/benoxacor (1.6 kg/ha)	COMMAND 360 ME (360 g/L) + DUAL II MAGNUM (915 g/L)	1.6–2.35 L/ha (0.64–0.94 L/acre) + 1.75 L/ha (0.7 L/acre)	• **Do NOT** use on natto soybeans. • Apply PRE. • **Do NOT** incorporate. • For light textured soils – Apply COMMAND at 1.6 L/ha (0.64 L/acre). • For medium textured soils – Apply COMMAND at 2.3 L/ha (0.92 L/acre). • For heavy textured soils – Apply COMMAND at 2.35 L/ha (0.94 L/acre). • Some rotational cropping restrictions apply (see Table 4–4. Herbicide Crop Rotation and Soil pH Restrictions: Field Crops, page 74).
clomazone (0.576–0.846 kg/ha) + linuron (0.96–1.080 kg/ha)	COMMAND 360 ME (360 g/L) + LOROX L (480 g/L)	1.6–2.35 L/ha (0.64–0.94 L/acre) + 2–2.25 L/ha (0.8–0.9 L/acre)	• **Do NOT** use on natto soybeans. • Apply PRE. • **Do NOT** incorporate. • For light textured soils – Apply COMMAND at 1.6 L/ha (0.64 L/acre) and LOROX L at 2 L/ha (0.8 L/acre). • For medium textured soils – Apply COMMAND at 2.3 L/ha (0.92 L/acre) and LOROX L at 2.25 L/ha (0.9 L/acre). • For heavy textured soils – Apply COMMAND at 2.35 L/ha (0.94 L/acre) and LOROX L at 2.25 L/ha (0.9 L/acre). • Some rotational cropping restrictions apply (see Table 4–4. Herbicide Crop Rotation and Soil pH Restrictions: Field Crops, page 74).

TABLE 11–3. Herbicide Treatment Rates for Conventional (Non-GMO) Soybean (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario page 27, and Chapter 5, Notes on Adjuvants, page 81.
Soil Applied Tank-Mix Options (cont'd)			
clomazone (0.576–0.846 kg/ha) + imazethapyr (0.075 kg/ha)	COMMAND 360 ME (360 g/L) + PURSUIT (240 g/L)	1.6–2.35 L/ha (0.64–0.94 L/acre) + 0.312 L/ha (0.126 L/acre)	· **Do NOT** use on natto soybeans. · Apply PRE. · **Do NOT** incorporate. · For light textured soils – Apply COMMAND at 1.6 L/ha (0.64 L/acre) (0.64 L/acre). · For medium textured soils – Apply COMMAND at 2.3 L/ha (0.94 L/acre). · For heavy textured soils – Apply COMMAND at 2.35 L/ha (0.94 L/acre). · Some rotational cropping restrictions apply (see Table 4–4. Herbicide Crop Rotation and Soil pH Restrictions: Field Crops, page 74).
clomazone (0.576–0.846 kg/ha) + metribuzin (0.281–0.398 kg/ha)	COMMAND 360 ME (360 g/L) + SENCOR 75 DF (75 WG)	1.6–2.35 L/ha (0.64–0.94 L/acre) + 0.375–0.530 kg/ha (0.15–0.212 kg/acre)	· **Do NOT** use on natto soybeans. · Apply PRE. · **Do NOT** incorporate. · For light textured soils – Apply COMMAND at 1.6 L/ha (0.64 L/acre) and SENCOR at 0.375 kg/ha (150 g/acre). · For medium textured soils – Apply COMMAND at 2.3 L/ha (0.92 L/acre) and SENCOR at 0.530 kg/ha (212 g/acre). · For heavy textured soils – Apply COMMAND at 2.35 L/ha (0.94 L/acre) and SENCOR at 0.530 kg/ha (212 g/acre). · Some rotational cropping restrictions apply (see Table 4–4. Herbicide Crop Rotation and Soil pH Restrictions: Field Crops, page 74).
s-metolachlor/benoxacor (1.05–1.6 kg/ha) + linuron (0.85–1.15 kg/ha)	DUAL II MAGNUM (915 g/L) + LOROX L (480 g/L)	1.15–1.75 L/ha (0.46–0.7 L/acre) + 1.77–2.39 L/ha (0.71–0.96 L/acre)	· Apply PRE. · Can be tank-mixed with GRAMOXONE for PP burndown of emerged annual and perennial weeds, see Chapter 6, Preplant & Postharvest Weed Control, page 91 for more information.
s-metolachlor/benoxacor (1.05–1.6 kg/ha) + metribuzin (0.41–1.13 kg/ha)	DUAL II MAGNUM (915 g/L) + SENCOR 75 DF (75 WG)	1.15–1.75 L/ha (0.46–0.7 L/acre) + 0.55–1.5 kg/ha (0.22–0.6 kg/acre)	· Apply PPI or PRE. · Can be tank-mixed with glyphosate or GRAMOXONE for PP burndown of emerged annual and perennial weeds, see Chapter 6, Preplant & Postharvest Weed Control, page 91 for more information.
s-metolachlor/benoxacor (1.05–1.6 kg/ha) + imazethapyr (0.075–0.1 kg/ha)	DUAL II MAGNUM (915 g/L) + PURSUIT (240 g/L)	1.15–1.75 L/ha (0.46–0.7 L/acre) + 0.312–0.42 L/ha (0.125–0.168 L/acre)	· Apply PP, PPI or PRE. · Maximum PURSUIT rate for PPI treatments is 0.312 L/ha.
dimethenamid-P (544–693 g/ha) + metribuzin (408–528 g/ha)	FRONTIER MAX (720 g/L) + SENCOR 480 F (480 g/L)	756–963 mL/ha (305–390 mL/acre) + 850 mL–1.1 L/ha (340–440 mL/acre)	· Apply PP, PPI or PRE. · Refer to precautions for FRONTIER MAX, page 203 and SENCOR, page 205.
	FRONTIER MAX (720 g/L) + SENCOR 75 DF (75%)	756–963 mL/ha (305–390 mL/acre) + 550–700 g/ha (220–280 g/acre)	

TABLE 11–3. Herbicide Treatment Rates for Conventional (Non-GMO) Soybean (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario page 27, and Chapter 5, Notes on Adjuvants, page 81.
dimethenamid-P (544–693 g/ha) + imazethapyr (0.075–0.1 kg/ha)	FRONTIER MAX (720 g/L) + PURSUIT (240 g/L)	756–963 mL/ha (305–390 mL/acre) + 0.312–0.42 L/ha (0.126–0.168 L/acre)	• Apply PP, PPI or PRE. • Refer to precautions for FRONTIER MAX, page 203 and PURSUIT, page 207.
Soil Applied Tank-Mix Options (cont'd)			
imazethapyr (75 g/ha) + cloransulam-methyl (17.5 g/ha)	PURSUIT (240 g/L) + FIRST RATE (84 WG)	0.312 L/ha (0.126 L/acre) + 20.8 g/ha (8.5 g/acre)	• Apply PP or PRE. • Can be tank-mixed with glyphosate for PP burndown of emerged annual and perennial weeds, see Chapter 6, Preplant & Postharvest Weed Control, page 91 for more information.
	PHANTOM (240 g/L) + FIRST RATE (84 WG)		
	NU-IMAGE (240 g/L) + FIRST RATE (84 WG)		
imazethapyr (75 g/ha) + pendimethalin (1,080 g/ha)	PURSUIT (240 g/L) + PROWL 400 EC (400 g/L)	0.312 L/ha (0.126 L/acre) + 2.7 L/ha (1.08 L/acre)	• Apply PPI up to 45 days before planting. • Can be tank-mixed with glyphosate for PP burndown of emerged annual and perennial weeds, see Chapter 6, Preplant & Postharvest Weed Control, page 91 for more information. • Allow 24 months between applications. • See Pursuit, page 207 for additional comments. • Refer to Table 4–4. Herbicide Crop Rotation and Soil pH Restrictions: Field Crops, page 74 for rotation restrictions.
imazethapyr (0.075–0.1 kg/ha) + linuron (0.85–1.15 kg/ha)	PURSUIT (240 g/L) + LOROX L (480 g/L)	0.312–0.42 L/ha (0.126–0.168 L/acre) + 1.77–2.39 L/ha (0.71–0.96 L/acre)	• Apply PRE.
	PHANTOM (240 g/L) + LOROX L (480 g/L)		
	NU-IMAGE (240 g/L) + LOROX L (480 g/L)		
imazethapyr (0.075–0.1 kg/ha) + metribuzin (0.4–1.13 kg/ha)	PURSUIT (240 g/L) + SENCOR 75 DF (75 WG)	0.31–0.42 L/ha (0.126–0.168 L/acre) + 0.53–1.5 kg/ha (0.21–0.6 kg/acre)	• Apply PP, PPI or PRE. • For preplant applications the maximum Sencor rate is 1.3 kg/ha (520 g/acre).
	PHANTOM (240 g/L) + SENCOR 75 DF (75 WG)		
	NU-IMAGE (240 g/L) + SENCOR 75 DF (75 WG)		

TABLE 11–3. Herbicide Treatment Rates for Conventional (Non-GMO) Soybean (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario page 27, and Chapter 5, Notes on Adjuvants, page 81.
Soil Applied Tank-Mix Options (cont'd)			
imazethapyr (0.075 kg/ha) + trifluralin (0.6–1.155 kg/ha)	PURSUIT (240 g/L) **or** PHANTOM (240 g/L) **or** NU-IMAGE (240 g/L) + TREFLAN (480 g/L)	0.312 L/ha (0.126 L/acre) + 1.25–2.4 L/ha (0.5–0.96 L/acre)	• Apply PPI.
	PURSUIT (240 g/L) **or** PHANTOM (240 g/L) **or** NU-IMAGE (240 g/L) + RIVAL (500 g/L)	0.312 L/ha (0.126 L/acre) + 1.2–2.3 L/ha (0.48–0.92 L/acre)	
	PURSUIT (240 g/L) **or** PHANTOM (240 g/L) **or** NU-IMAGE (240 g/L) + BONANZA 480 (480 g/L)	0.312 L/ha (0.126 L/acre) + 1.25–2.4 L/ha (0.5–0.96 L/acre)	
metribuzin (0.33–0.75 kg/ha) + linuron (0.5–1.2 kg/ha)	SENCOR 75 DF (75 WG) + LOROX L (480 g/L)	0.44–1 kg/ha (0.18–0.4 kg/acre) + 1.04–2.5 L/ha (0.42–1 L/acre)	• Apply PRE.
trifluralin (0.6–1.155 kg/ha) + metribuzin (0.42–0.55 kg/ha)	TREFLAN EC (480 g/L) + SENCOR 75 DF (75 WG)	1.25–2.4 L/ha (0.5–0.96 L/acre) + 0.56–0.73 kg/ha (0.22–0.29 kg/acre)	• Apply PPI.
	RIVAL (500 g/L) + SENCOR 75 DF (75 WG)	1.2–2.3 L/ha (0.48–0.92 L/acre) + 0.56–0.73 kg/ha (0.22–0.29 kg/acre)	
	BONANZA 480 (480 g/L) + SENCOR 75 DF (75 WG)	1.25–2.4 L/ha (0.5–0.96 L/acre) + 0.56–0.73 kg/ha (0.22–0.29 kg/acre)	
Postemergence Grass Herbicides			
quizalofop-p-ethyl (0.036–0.072 kg/ha) + oil concentrate (0.5% v/v)	ASSURE II (96 g/L) + SURE-MIX	0.38–0.75 L/ha (0.15–0.3 L/acre) + 5 L/1,000 L	• Apply to emerged annual grasses and volunteer cereals in 2 leaf to tillering stage and volunteer corn and quackgrass in the 2–6 leaf stage. • Use the 0.38 L/ha (0.15 L/acre) rate of ASSURE II for control of volunteer corn, volunteer cereals, long spined sandbur and green foxtail. • Volunteer "ENLIST" corn **WILL NOT** be controlled by this herbicide. • The 0.5 L/ha (0.2 L/acre) rate of ASSURE II will suppress quackgrass and also control barnyard grass. • Use the 0.75 L/ha (0.3 L/acre) rate of ASSURE II for control of quackgrass. • **Do NOT** apply to soybeans within 80 days of harvest.
	YUMA GL (96 g/L) + XA OIL CONCENTRATE		
fenoxaprop-p-ethyl (0.054 kg/ha)	EXCEL SUPER (80.5 g/L)	0.67 L/ha (0.27 L/acre)	• Apply to emerged annual grasses in the 1–6 leaf stage, which are actively growing while crop is small enough to permit thorough coverage. • A second application may be necessary to control later emerging grasses. • Volunteer "ENLIST" corn **WILL NOT** be controlled by this herbicide.

TABLE 11–3. Herbicide Treatment Rates for Conventional (Non-GMO) Soybean (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario page 27, and Chapter 5, Notes on Adjuvants, page 81.
Postemergence Grass Herbicides (cont'd)			
sethoxydim (0.15–0.2 kg/ha) + oil concentrate (2 L/ha)	POAST ULTRA (450 g/L) + ASSIST	0.32–0.47 L/ha (0.13–0.19 L/acre) + 2 L/ha (0.8 L/acre)	• Apply the 0.47 L/ha (0.19 L/acre) rate for wild oats or volunteer cereal control. • Apply POAST ULTRA to emerged grasses in the 1–6 leaf stage during active growth while crop is small enough to permit thorough spray coverage. • Complete control is normally obtained 7–21 days after application. A second application may be necessary to control grasses that emerge after the first treatment. • Use MERGE for conditions or weeds requiring medium to high rates of POAST ULTRA. • Water rates of 100–200 L/ha (40–80 L/acre) provide the best results.
sethoxydim (0.15–0.2 kg/ha) + surfactant/solvent (1 L/ha)	POAST ULTRA (450 g/L) + MERGE	0.32–0.47 L/ha (0.13–0.19 L/acre) + 1 L/ha (0.4 L/acre)	
sethoxydim (0.5 kg/ha) + surfactant/solvent (1–2 L/ha)	POAST ULTRA (450 g/L) + MERGE	1.1 L/ha (0.45 L/acre) + 1–2 L/ha (0.4–0.8 L/acre)	• Apply at 1–3 leaf stage of actively growing quackgrass in 110–200 L/ha (44–80 L/acre) water. • Thorough preplant tillage will result in more uniform quackgrass emergence. • Crop competition and inter-row cultivation 7–14 days after application will assist in quackgrass control for 6–8 weeks.
clethodim (0.03–0.09 kg/ha) + surfactant (0.5–1% v/v)	SELECT (240 g/L) + AMIGO	0.125–0.375 L/ha (0.05–0.15 L/acre) + 5–10 L/1,000 L	• Soybeans are tolerant at any growth stage. • Apply when annual grasses and volunteer cereals are in the 2–6 leaf stage. • Use the higher rate for quackgrass control. Apply to quackgrass in the 2–5 leaf stage. • Add the surfactant AMIGO at 5 L/1,000 L of spray solution to the low herbicide rate and 10 L/1,000 L of spray solution to the high herbicide rate for quackgrass control.
	ARROW (240 g/L) + ADDIT ADJUVANT		
fluazifop-P-butyl (0.075–0.25 kg/ha)	VENTURE L (125 g/L)	0.6–2 L/ha (0.243–0.8 L/acre)	• The 0.6 L/ha (0.243 L/acre) rate is for the control of volunteer corn at the 2–5 leaf stage. • The 1 L/ha (0.4 L/acre) rate is for the control of annual grasses at the 2–4 leaf stage. • Volunteer "ENLIST" corn **WILL NOT** be controlled by this herbicide. • The 2 L/ha (0.8 L/acre) rate is for the control of quackgrass or wirestem muhly at the 3–5 leaf stage.
Postemergence Broadleaf Herbicides			
bentazon (0.84–1.08 kg/ha)	BASAGRAN FORTÉ (480 g/L)	1.75–2.25 L/ha (0.7–0.9 L/acre)	• Apply when soybeans are in unifoliate to 4th trifoliate leaf stage and when weeds are small and actively growing. • Temporary crop injury may occur under abnormally hot, humid conditions. • Cool weather or drought may delay control. • For improved and more consistent control of velvetleaf and lamb's-quarters, 10 L/ha of 28% urea ammonium nitrate (UAN) or 6 L/ha of liquid ammonium sulphate may be added. The addition of either nitrogen source may cause slight leaf burn, but new growth is normal and crop vigour is not reduced. • Use the higher rate of BASAGRAN FORTÉ when weed pressure is high, weeds are large or conditions for activity are unfavourable.

TABLE 11–3. Herbicide Treatment Rates for Conventional (Non-GMO) Soybean (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario page 27, and Chapter 5, Notes on Adjuvants, page 81.
Postemergence Broadleaf Herbicides (cont'd)			
acifluorfen (0.6 kg/ha)	BLAZER (240 g/L)	2.5 L/ha (1 L/acre)	· Apply to emerged weeds up to 10 cm in height (refer to labels for weed heights) when soybeans are in the 1–3 trifoliate leaf stage. · **Do NOT** apply before the first trifoliate leaf stage of the soybeans. · Good spray coverage on the weeds is important for good weed control. · Soybeans may exhibit speckling, bronzing and/or leaf burn. The trifoliate leaf emerging at the time of application may be distorted. Soybeans usually outgrow these conditions and continue to grow at a normal rate with no adverse effect on vigour, maturity, or crop yield. · **Do NOT** apply BLAZER to soybeans that have been subjected to stress (see product label). · **Do NOT** add oils or surfactants to applications of BLAZER at 2.5 L/ha alone.
acifluorfen (0.3 kg/ha) + oil concentrate (0.5% v/v)	BLAZER (240 g/L) + ASSIST	1.25 L/ha (0.5 L/acre) + 5 L/1,000 L	· Apply to emerged redroot pigweed up to and including the 4 leaf stage and to common ragweed up to and including the 8 leaf stage when soybeans are in the 1–3 trifoliate leaf stage. · **Do NOT** apply before the first trifoliate leaf stage of the soybeans. · Good spray coverage on the weeds is important for good weed control. · Soybeans may exhibit speckling, bronzing and/or leaf burn. The trifoliate leaf emerging at the time of application may be distorted. Soybeans usually outgrow these conditions and continue to grow at a normal rate with no adverse affects on vigour, maturity or crop yield.
chlorimuron-ethyl (9 g/ha) + non-ionic surfactant (0.2% v/v)	CLASSIC (25 DF) + non-ionic surfactant CHAPERONE (25 DF) + non-ionic surfactant	36 g/ha (14 g/acre) + 2 L/1,000 L	· Apply to small emerged weeds (2–6 leaf) and ideally when soybeans have the 1st trifoliate leaf fully expanded. Applications may occur prior to the 1st trifoliate leaf stage if targeted weed species are at the maximum leaf stage for control. · **Do NOT** apply after the initiation of flowering. · Addition of 28% UAN may improve control of velvetleaf. · Some rotational cropping restrictions apply (see Table 4–4. Herbicide Crop Rotation and Soil pH Restrictions: Field Crops, page 74).
cloransulam-methyl (17.5 g/ha) + non ionic surfactant (0.25% v/v) + liquid fertilizer (2.5% v/v)	FIRSTRATE (84 WG) + non-ionic surfactant + liquid fertilizer (28-0-0 or 32-0-0)	20.8 g/ha (8.5 g/acre) + 2.5 L/1,000 L + 25 L/1,000 L	· Apply up to the 8 leaf stage for common ragweed and cocklebur, 6 leaf stage for giant ragweed, and 4 leaf stage for velvetleaf. · Apply any time prior to flowering stage of soybeans. · Application prior to full emergence of first trifoliate may cause temporary yellowing of soybeans.

TABLE 11–3. Herbicide Treatment Rates for Conventional (Non-GMO) Soybean (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario page 27, and Chapter 5, Notes on Adjuvants, page 81.
Postemergence Broadleaf Herbicides (cont'd)			
thifensulfuron-methyl (4.1–6 g/ha) + surfactant (0.1% v/v)	PINNACLE SG (50%) + non ionic surfactant	8.25–12 g/ha (3.3–4.8 g/acre) + 1 L/1,000 L	· Apply to small emerged weeds (2–6 leaf) and ideally when soybeans have the 1st trifoliate leaf fully expanded. Applications may occur prior to the 1st trifoliate leaf stage if targeted weed species are at the maximum leaf stage for control. · **Do NOT** apply to soybeans, which have initiated flowering. · Use the higher rate for lamb's-quarters and velvetleaf. · The addition of UAN (28-0-0) at 4% v/v will enhance the control of velvetleaf. · **NOTE:** If using PINNACLE (75 DF), the product rate is 5.5–8 g/ha (2.2–3.2 g/acre) but the adjuvant rate remains the same.
fomesafen (0.24 kg/ha) + mineral oil/surfactant (0.5% v/v)	REFLEX (240 g/L) + TURBOCHARGE	1 L/ha (0.4 L/acre) + 5 L/1,000 L	· Apply early postemergence at 1–2 trifoliate to crop when weeds are small and actively growing (2–4 leaf stage). · Use 200–350 L/ha (80–140 L/acre) water. Use higher rates of water and pressure for a heavy weed or crop canopy. · Some bronzing may occur to soybean leaves at the time of application, but plants outgrow these effects without harming maturity or yield. · **Do NOT** apply REFLEX to any field more often than once every 2 years. · **Do NOT** apply to soybeans under stress. · Some rotational cropping restrictions apply (see Table 4–4. Herbicide Crop Rotation and Soil pH Restrictions: Field Crops, page 74).
Postemergence Grass and Broadleaf Herbicides			
imazethapyr (0.075–0.1 kg/ha) + non-ionic surfactant (0.25% v/v) + liquid fertilizer (2 L/ha)	PURSUIT (240 g/L) + non-ionic surfactant + liquid fertilizer (28-0-0, 10-34-0, or 32-0-0)	0.312–0.42 L/ha (126–168 mL/acre) + 2.5 L/1,000 L + 2 L/ha (0.8 L/acre)	· Apply when the weeds are up to the 2-true leaf stage. · Some rotational cropping restrictions apply (see label and Table 4–4. Herbicide Crop Rotation and Soil pH Restrictions: Field Crops, page 74). · Use only **ONCE** per season.
	PHANTOM (240 g/L) + non-ionic surfactant + liquid fertilizer (28-0-0, 10-34-0, or 32-0-0)		
	NU-IMAGE (240 g/L) + non-ionic surfactant + liquid fertilizer (28-0-0, 10-34-0, or 32-0-0)		
imazethapyr/ bentazon (0.075 + 0.84 kg/ha) + liquid fertilizer (2 L/ha)	CLEAN SWEEP (sold as a co-pack): (PURSUIT (240 g/L) + BASAGRAN FORTÉ (480 g/L) + liquid fertilizer (28-0-0, 10-34-0 or 32-0-0)	0.312 L/ha (0.126 L/acre) + 1.75 L/ha (0.7 L/acre) + 2 L/ha (0.8 L/acre)	· Available as a co-pack containing PURSUIT and BASAGRAN FORTÉ. · Apply postemergence to actively growing weeds in the 2–6 leaf stage. · Some rotational cropping restrictions apply (see label and Table 4–4. Herbicide Crop Rotation and Soil pH Restrictions: Field Crops, page 74).

TABLE 11–3. Herbicide Treatment Rates for Conventional (Non-GMO) Soybean (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario page 27, and Chapter 5, Notes on Adjuvants, page 81.
Postemergence Tank-Mix Options			
quizalofop-p-ethyl (0.06 kg/ha) + thifensulfuron-methyl (4.1–6 g/ha) + bentazon (0.84–1.08 kg/ha) + oil concentrate (0.5% v/v)	ASSURE II (96 g/L) + PINNACLE SG (50%) + BASAGRAN FORTÉ (480 g/L) + SURE-MIX	0.63 L/ha (0.25 L/acre) + 8.25–12 g/ha (3.3–4.8 g/acre) + 1.75–2.25 L/ha (0.7–0.9 L/acre) + 5 L/1,000 L	· Apply to soybeans from the 1–4 trifoliate leaf stage. Applications may occur prior to the 1st trifoliate leaf stage of soybean if targeted weed species are at the maximum leaf stage for control. · **Do NOT** apply to soybeans, which have initiated flowering. · If leaf stages of the grass and broadleaf weeds do not coincide, a sequential application of the grass and broadleaf herbicides is required to ensure satisfactory control. · **NOTE:** If using PINNACLE (75 DF), the product rate is 5.5–8 g/ha (2.2–3.2 g/acre) but the adjuvant rate remains the same.
	YUMA GL (96 g/L) + PINNACLE SG (50%) + BASAGRAN FORTÉ (480 g/L) + SURE-MIX	0.63 L/ha (0.25 L/acre) + 8.25–12 g/ha (3.3–4.8 g/acre) + 1.75–2.25 L/ha (0.7–0.9 L/acre) + 5 L/1,000 L	
quizalofop-p-ethyl (0.048 kg/ha) + thifensulfuron-methyl (4.1–6 g/ha) + oil concentrate (0.5% v/v)	ASSURE II (96 g/L) + PINNACLE SG (50%) + SURE-MIX	0.5 L/ha (0.2 L/acre) + 8.25–12 g/ha (3.3–4.8 g/acre) + 5 L/1,000 L	· Apply to soybeans from the 1–3 trifoliate leaf stage. Applications may occur prior to the 1st trifoliate leaf stage of soybean if targeted weed species are at the maximum leaf stage for control. · **Do NOT** apply to soybeans that have initiated flowering. · If leaf stages of the grass and broadleaf weeds do not coincide, a sequential application of the grass and broadleaf herbicides is required to ensure satisfactory control. · Velvetleaf control may be reduced with a tank-mix application. · For optimum control, make separate applications of PINNACLE and ASSURE. · **NOTE:** If using PINNACLE (75 DF), the product rate is 5.5–8 g/ha (2.2–3.2 g/acre) but the adjuvant rate remains the same.
	YUMA GL (96 g/L) + PINNACLE SG (50%) + SURE-MIX		
quizalofop-p-ethyl (0.036–0.060 kg/ha) + chlorimuron-ethyl (9.0 g/ha) + oil concentrate (0.5%–1.0%)	ASSURE II (96 g/L) + CLASSIC (25 DF) + SURE-MIX	0.38–0.63 L/ha (0.15–0.255 L/acre) + 36 g/ha (14 g/acre) + 5 L/1,000 L	· Apply to soybeans from the 1–3 trifoliate leaf stage. Applications may occur prior to the 1st trifoliate leaf stage of soybean if targeted weed species are at the maximum leaf stage for control. · **Do NOT** apply to soybeans that have initiated flowering. · If leaf stages of the grass and broadleaf weeds do not coincide, a sequential application of the grass and broadleaf herbicides is required to ensure satisfactory control. · If targeting yellow foxtail or quackgrass use ASSURE II at a rate of 0.63 L/ha.
	ASSURE II (96 g/L) + CHAPERONE (25DF) + SURE-MIX		
	YUMA GL (96 g/L) + CLASSIC (25 DF) + SURE-MIX		
	YUMA GL (96 g/L) + CHAPERONE (25DF) + SURE-MIX		
acifluorfen (0.3 kg/ha) + bentazon (0.6 kg/ha)	BLAZER (240 g/L) + BASAGRAN FORTÉ (480 g/L)	1.25 L/ha (0.5 L/acre) + 1.25 L/ha (0.5 L/acre)	· Use when common ragweed and/or redroot pigweed are the dominant weed(s).

TABLE 11–3. Herbicide Treatment Rates for Conventional (Non-GMO) Soybean (cont'd)

ACTIVE INGREDIENT (rate)	**TRADE NAME** (Concentration)	**PRODUCT RATE**	**PRECAUTIONS** For more information, see Chapter 4, Herbicides Used in Ontario page 27, and Chapter 5, Notes on Adjuvants, page 81.
Postemergence Tank-Mix Options (cont'd)			
acifluorfen (0.15 kg/ha) + bentazon (0.84 kg/ha)	BLAZER (240 g/L) + BASAGRAN FORTÉ (480 g/L)	0.63 L/ha (0.25 L/acre) + 1.75 L/ha (0.7 L/acre)	- Use when lamb's-quarters is the dominant weed.
fenoxaprop-p-ethyl (0.054 kg/ha) + bentazon (0.84–1.08 kg/ha)	EXCEL SUPER (80.5 g/L) + BASAGRAN FORTÉ (480 g/L)	0.67 L/ha (0.27 L/acre) + 1.75–2.25 L/ha (0.7–0.9 L/acre)	- If annual broadleaf and grassy weeds are not in the correct stage for a tank-mix application, use a split application at the correct stage for each product.
fenoxaprop-p-ethyl (0.054 kg/ha) + bentazon (0.84–1.08 kg/ha) + thifensulfuron-methyl (4.1–6 g/ha)	EXCEL SUPER (80.5 g/L) + BASAGRAN FORTÉ (480 g/L) + PINNACLE SG (50%)	0.67 L/ha (0.27 L/acre) + 1.75–2.25 L/ha (0.7–0.9 L/acre) + 8.25–12 g/ha (3.3–4.8 g/acre)	- If broadleaf and grassy weeds are not in the correct stage for a tank-mix application, use a split application at the correct stage for each product. - **NOTE:** If using PINNACLE (75 DF), the product rate is 5.5–8 g/ha (2.2–3.2 g/acre) but the adjuvant rate remains the same.
fenoxaprop-p-ethyl (0.054 kg/ha) + thifensulfuron-methyl (4.1–6 g/ha)	EXCEL SUPER (80.5 g/L) + PINNACLE SG (50%)	0.67 L/ha (0.27 L/acre) + 8.25–12 g/ha (3.3–4.8 g/acre)	- If broadleaf and grassy weeds are not in the correct stage for a tank-mix application, use a split application at the correct stage for each product. - **NOTE:** If using PINNACLE (75 DF), the product rate is 5.5–8 g/ha (2.2–3.2 g/acre) but the adjuvant rate remains the same.
thifensulfuron-methyl (4.1–6 g/ha) + bentazon (0.84–1.08 kg/ha)	PINNACLE SG (50%) + BASAGRAN FORTÉ (480 g/L)	8.25–12 g/ha (3.3–4.8 g/acre) + 1.75–2.25 L/ha (0.7–0.9 L/acre)	- Apply to emerged weeds when soybeans have the first trifoliate leaf fully expanded. - **Do NOT** apply to soybeans that have initiated flowering. - If Canada thistle, yellow nutsedge and field bindweed are target species a 2nd application may be required. - **NOTE:** If using PINNACLE (75 DF), the product rate is 5.5–8 g/ha (2.2–3.2 g/acre) but the adjuvant rate remains the same.
fomesafen (0.24 kg/ha) + thifensulfuron-methyl (6 g/ha) + non-ionic surfactant (0.25% v/v)	REFLEX (240 g/L) + PINNACLE SG (50%) + AGRAL 90	1 L/ha (0.4 L/acre) + 12 g/ha (4.8 g/acre) + 2.5 L/1,000 L	- Apply early postemergence at the 2–4 leaf stage of weeds and 1–2 trifoliate stage of the crop. - **NOTE:** If using PINNACLE (75 DF), the product rate is 5.5–8 g/ha (2.2–3.2 g/acre) but the adjuvant rate remains the same.

TABLE 11–3. Herbicide Treatment Rates for Conventional (Non-GMO) Soybean (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario page 27, and Chapter 5, Notes on Adjuvants, page 81.
Postemergence Tank-Mix Options (cont'd)			
fomesafen (0.24 kg/ha) + fluazifop-p-butyl (6 g/ha) + surfactant (0.5% v/v)	REFLEX (240 g/L) + VENTURE L (125 g/L) + TURBOCHARGE-	1 L/ha (0.4 L/acre) + 0.6–2.0 L/ha (0.243–0.8 L/acre) + 5 L/1,000 L	- Apply early postemergence at the 2–4 leaf stage of weeds and 1–2 trifoliate stage of the crop. - Apply in 200 L/ha (80 L/acre) water.
imazethapyr (75 g/ha) + cloransulan-methyl (17.5 g/ha) + non-ionic surfactant (0.25% v/v) + liquid fertilizer (2 L/ha)	PURSUIT (240 g/L) + FIRSTRATE (84 WG) + non-ionic surfactant + liquid fertilizer (28-0-0 or 32-0-0)	0.312 L/ha (0.126 L/acre) + 20.8 g/ha (8.5 g/acre) + 2.5 L/1,000 L + 2 L/ha (0.8 L/acre)	- Apply when weeds are up to the 2-true leaf stage. - Use for control of annual grasses, lamb's-quarters and redroot pigweed.
imazethapyr (0.075 kg/ha) + fomesafen (0.19–0.24 kg/ha) + non-ionic surfactant (0.25% v/v) + liquid fertilizer (2 L/ha)	PURSUIT (240 g/L) + REFLEX (240 g/L) + AGRAL 90 + liquid fertilizer	0.312 L/ha (0.126 L/acre) + 0.8–1 L/ha (0.32–0.4 L/acre) + 2.5 L/1,000 L + 2 L/ha (0.8 L/acre)	- Use the lower rate of REFLEX for ragweed only. - Use the higher rate of REFLEX for lamb's-quarters.
fluazifop-p-butyl (0.125–0.25 kg/ha) + bentazon (0.84–1.08 kg/ha) + oil concentrate (0.5% v/v)	VENTURE L (125 g/L) + BASAGRAN (480 g/L) + ASSIST	1–2 L/ha (0.4–0.8 L/acre) + 1.75–2.25 L/ha (0.7–0.9 L/acre) + 5 L/1,000 L	- Apply when soybeans are at the unifoliate to 3rd trifoliate stage and when weeds are small and actively growing. - Use the 0.8 L/acre rate of VENTURE L to control wirestem muhly. - Temporary crop injury may occur under abnormally hot and humid conditions.
Spot Treatments – see Spot Treatments with Hand-Held Equipment, page 100 for a list of options.			
Wick Wiper and Roller Application – see Wick Wiper and Roller Application, page 100 for a list of options.			

TABLE 11–3. Herbicide Treatment Rates for Conventional (Non-GMO) Soybean (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario page 27, and Chapter 5, Notes on Adjuvants, page 81.
Preharvest			
carfentrazone-ethyl (0.0175–0.028 kg/ha) + non-ionic surfactant (0.25% v/v)	AIM EC (240 g/L) + non-ionic surfactant	0.073–0.117 L/ha (30–47 mL/acre) + 2.5 L/1,000 L	· Apply to actively growing weeds, up to 10 cm. · Coverage of weed and crop foliage is essential for control. · Preharvest interval (PHI) is 3 days.
carfentrazone-ethyl (0.0175–0.028 kg/ha) + MERGE (0.1% v/v)	AIM EC (240 g/L) + MERGE	0.073–0.117 L/ha (30–47 mL/acre) + 10 L/1,000 L	
saflufenacil (25.2–49.7 g/ha) + adjuvant (1 L/ha)	ERAGON (70% SG) + MERGE	36–71 g/ha (14.4–28.4 g/acre) + 1 L/ha (0.4 L/acre)	· Apply when the stems are green to brown in colour and pods are mature (yellow-brown) and 80%–90% of the original leaves have dropped. · Apply in 200 L/ha (80 L/acre) of water. · Preharvest interval (PHI) is 3 days.
	ERAGON LQ (342 g/L) + MERGE	73–146 mL/ha (29.5–59 mL/acre) + 1 L/ha (0.4 L/acre)	
saflufenacil (25.2–49.7 g/ha) + glyphosate (900 g/ha) + adjuvant (1 L/ha)	ERAGON (70% SG) + glyphosate (360 g/L)* + MERGE	36–71 g/ha (14.4–28.4 g/acre) + 2.5 L/ha (1 L/acre) + 1 L/ha (0.4 L/acre)	· Apply when the stems are green to brown in colour and pods are mature (yellow-brown) and 80%–90% of the original leaves have dropped. · Apply in 200 L/ha (80 L/acre) of water. · **Do NOT** apply to crops grown for seed. · Refer to preharvest precautions for glyphosate, below. * Numerous products exist, refer to Table 11-7. Glyphosate Products Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant "Roundup Ready" Soybean, page 225 for a complete list of registered products.
	ERAGON LQ (342 g/L) + glyphosate (360 g/L)* + MERGE	73–146 mL/ha (29.5–59 mL/acre) + 2.5 L/ha (1 L/acre) + 1 L/ha (0.4 L/acre)	
glyphosate (0.9 kg/ha)	glyphosate (360 g/L)*	2.5 L/ha (1 L/acre)	· Apply in 50–100 L/ha (20–40 L/acre) water when the crop is 30% grain moisture or less. · **Do NOT** apply to crops grown for seed. · Apply at least 7 days prior to harvest when pod tissue is dry and brown and 80%–90% of original leaves have dropped. * Numerous products exist, refer to Table 11-7. Glyphosate Products Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant "Roundup Ready" Soybean, page 225 for a complete list of registered products.
	other glyphosate products	See Table 11–6, on page 224.	
diquat (0.30–0.55 kg/ha) + surfactant (0.1% v/v)	REGLONE DESICCANT (240 g/L) + AGRAL 90	1.25–2.3 L/ha (0.5–0.92 L/acre) + 1 L/1,000 L	· Apply in 225 L/ha water to burn off weeds when 80% natural crop leaf defoliation has occurred and 80% of the pods have turned yellow. · Avoid regrowth by targeting spray within 7 days of variety maturity date and harvest 5–7 days after application. · For ground application use 1.25–1.7 L/ha (0.5–0.68 L/acre). · For aerial application use 1.7–2.3 L/ha (0.68–0.92 L/acre).

Glyphosate Tolerant ("Roundup Ready") Soybean

Weed Management Strategies for Glyphosate Tolerant Soybean

University of Guelph research trials have shown that when weed competition is high, two applications of glyphosate in glyphosate tolerant soybeans maximized yields and gross returns over 5 years at multiple locations in Ontario, see table 11–4. below.

TABLE 11–4. Soybean Yield From Different Weed Management Strategies in Glyphosate Tolerant Soybeans

Time of Glyphosate Application	Weed Control (% visual)	Yield (%)
Preplant followed by a Post application at the 1–3 trifoliate stage	96	100
Unifoliate followed by a Post application at the 1–3 trifoliate stage	96	98
Post at the 1–3 trifoliate stage (no Preplant Burndown applied)	93	83

Source: Swanton and Deen, 1999, University of Guelph.

In fields with historically low weed pressure and where the in-crop glyphosate application is not delayed past the third trifoliate stage there is little benefit to applying a residual herbicide. In fields with historically high weed pressure and when there is a risk of delayed in-crop glyphosate application (for reasons such as poor spraying conditions or a large amount of acres over a large geographic area) the application of a residual herbicide will minimize any risk of yield losses due to early season weed competition. It is important to select a residual herbicide that addresses the weed spectrum in your field. Refer to the weed control ratings for soil applied herbicide in Table 11–1. *Conventional Soybean Herbicide Weed Control Ratings,* page 193.

Glyphosate Resistant Weeds

Giant Ragweed – Populations resistant to glyphosate exist in southwestern Ontario. University of Guelph research has shown that, to date, an application of 2,4-D Ester 700 + glyphosate made 7 days prior to planting soybeans, is the most effective way to control emerged glyphosate resistant giant ragweed prior to seeding. FIRSTRATE provides the best control of glyphosate resistant giant ragweed postemergence in glyphosate tolerant soybeans. However, there are populations of giant ragweed that are also resistant to group 2 herbicides such as FIRSTRATE. LOROX provides effective residual control of giant ragweed when the highest label rate is used.

Canada Fleabane

Glyphosate resistant Canada fleabane is most difficult to control in soybean because of a lack of options to control it once the soybean crop has emerged. Therefore it must be controlled prior to planting. When research trials were initially conducted, the pre-plant tank-mix of glyphosate + ERAGON LQ + MERGE was the most effective option. However, as that treatment was evaluated over several seasons and locations, about one third of the time, glyphosate + ERAGON LQ + MERGE failed to provide commercially acceptable control of glyphosate resistant Canada fleabane. To address this inconsistency, different tank-mix options were evaluated over two seasons and the addition of SENCOR 75 DF (metribuzin) at 533 g/ha (216 g/acre) to the pre-plant tank-mix of glyphosate + ERAGON LQ + MERGE improved control of glyphosate resistant Canada fleabane. The equivalent rate of metribuzin used in SENCOR 75 DF can also found in herbicides like CONQUEST LQ and CANOPY PRO.

Common Ragweed

If glyphosate resistant common ragweed is emerged prior to planting then the tank-mix of glyphosate + ERAGON LQ + MERGE is the best option to control populations of this resistant species. SENCOR 75DF (metribuzin) applied pre-plant at the highest labelled rate has provided effective residual control of glyphosate resistant common ragweed, however this rate can only be safely used on clay soils that have greater than 4% organic matter, otherwise unacceptable crop injury is likely. When glyphosate resistant common ragweed is present when the soybean crop has emerged then either FLEXSTAR GT + TURBOCHARGE or glyphosate + REFLEX + TURBOCHARGE has provided the best control of this species in Roundup Ready Soybeans.

Waterhemp

Control of glyphosate resistant waterhemp is best achieved with a two-pass herbicide program where one of BOUNDARY LQD, FIERCE, FOCUS, FRONTIER or VALTERA, MAX is applied preemergence. If a second flush of waterhemp emerges once the crop has emerged, then one of REFLEX or BLAZER can be applied.

NOTES: Weed control ratings are given as 0–9 where 0 indicates no control and 9 indicates 90%–100% control under ideal conditions. Ratings are subjective values based on best available information and give general comparisons based on use as described in this guide. Under unfavourable conditions (e.g., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated. Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used. Always refer to the product label for more information on registered weed species, product uses and precautions

TABLE 11–5. Soybean Herbicide Weed Control Ratings in Glyphosate Tolerant Soybeans

LEGEND: Numbers (0–9) = weed control ratings
Crop tolerance ratings: E = Excellent, G = Good, F = Fair, P = Poor
– = insufficient information available to make a rating
* = sold as a co-pack under this trade name
R = populations resistant to this herbicide exist in Ontario and won't be adequately controlled if present.

		Grasses								Annual Broadleaves											Perennials							
Trade Name	**Stage**	**barnyard grass**	**crabgrass**	**fall panicum**	**foxtail, giant**	**foxtail, green**	**foxtail, yellow**	**witchgrass**	**proso millet**	**buckwheat, wild**	**cocklebur**	**fleabane, Canada**	**lady's thumb**	**lamb's-quarters**	**mustards**	**nightshades, annual**	**pigweeds**	**ragweed, common**	**ragweed, giant**	**velvetleaf**	**bindweed, field**	**horsetail**	**milkweed**	**nutsedge**	**quackgrass**	**sow-thistle**	**thistle, Canada**	**Crop Tolerance**
Preplant Burndown Herbicides																												
ASSIGNMENT*	emerged weeds	9	9	9	9	9	9	9	9	8	9	8^R	8	9	9	9	9	9^R	8^R	9	7/8	5	8	8[1]	9	8	9	E[1]
	residual weed control	–	–	8	–	9	9	–	7	–	4	2	9	8^R	9	9^R	9^R	8^R	5^R	8	0	0	0	–	0	0	0	
BLACKHAWK	emerged weeds	–	–	–	–	–	–	–	–	–	9	7	9	9	–	9	9	9	9	9	–	–	–	–	–	–	–	G
	residual weed control	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
CANOPY PRO* + glyphosate	emerged weeds	9	9	9	9	9	9	9	9	8	9	8^R	8	9	9	9	9	9^R	8^R	9	7/8	5	8	8	9	8	9	G
	residual weed control	7	6	7	5	5	5	8	3	8	7^R	8^R	9	9^R	9	9^R	9^R	8^R	8^R	9	2	2	2	2	8	2	2	
ERAGON + glyphosate + MERGE	emerged weeds	9	9	9	9	9	9	9	9	8	9	9	8	9	9	9	9	9	7/8	9	7/8	7	8	8[1]	9	8	9	E
	residual weed control	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
FLEXSTAR GT	emerged weeds	9	9	9	9	9	9	9	9	8	9	8^R	8	9	9	9	9	9	8^R	9	7/8	7	8	8[1]	9	8	9	E[2]
	residual weed control	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	8	8	–	–	–	–	–	–	–	–	–	
FREESTYLE* + glyphosate	emerged weeds	9	9	9	9	9	9	9	9	8	9	8^R	8	9	9	9	9	9^R	8^R	9	7/8	5	8	8	9	8	9	E
	residual weed control	8	7	7	9^R	9^R	9	8	7	8	7^R	8^R	9	9^R	9	9^R	9^R	8^R	8^R	9	2	2	2	8	2	2	2	

[1] A glyphosate rate of 1.8 kg/ha is required to achieve this level of control.

[2] Use only on certified soybean seed designated as "Roundup Ready" Soybean.

[3] Numerous products exist. See Table 11–7. Glyphosate Products Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant "Roundup Ready" Soybean, page 225, for a complete list of registered products.

TABLE 11–5. Soybean Herbicide Weed Control Ratings in Glyphosate Tolerant Soybeans (cont'd)

LEGEND: Numbers (0–9) = weed control ratings   Crop tolerance ratings: E = Excellent, G = Good, F = Fair, P = Poor   – = insufficient information available to make a rating
* = sold as a co-pack under this trade name
R = populations resistant to this herbicide exist in Ontario and won't be adequately controlled if present.

		Grasses								Annual Broadleaves											Perennials							
Trade Name	**Stage**	**barnyard grass**	**crabgrass**	**fall panicum**	**foxtail, giant**	**foxtail, green**	**foxtail, yellow**	**witchgrass**	**proso millet**	**buckwheat, wild**	**cocklebur**	**fleabane, Canada**	**lady's thumb**	**lamb's-quarters**	**mustards**	**nightshades, annual**	**pigweeds**	**ragweed, common**	**ragweed, giant**	**velvetleaf**	**bindweed, field**	**horsetail**	**milkweed**	**nutsedge**	**quackgrass**	**sow-thistle**	**thistle, Canada**	**Crop Tolerance**
Preplant Burndown Herbicides (cont'd)																												
GUARDIAN*	emerged weeds	9	9	9	9	9	9	9	9	8	9	8^R	8	9	9	9	9	9^R	8^R	9	7/8	5	8	8	9	8	9	G
	residual weed control	7	7	6	6^R	6^R	6	6	7	8	4	8^R	8	7^R	9	2	7^R	7^R	7^R	7	5	3	8	8	5	5	5	
GUARDIAN PLUS*	emerged weeds	9	9	9	9	9	9	9	9	8	9	8^R	8	9	9	9	9	9^R	8^R	9	7/8	5	8	8	9	8	9	G
	residual weed control	7	7	6	5	5	6	6	7	8	8	8^R	8	9	9	9	9	7	4	7	5	3	8	8	5	5	5	
glyphosate[3] + 2,4-D Ester 700	emerged weeds	9	9	9	9	9	9	9	9	8	9	8	8	9	9	9	9	9	9	9	8	5	8	82	9	8	9	G
	residual weed control	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	
glyphosate[3] + INTEGRITY + MERGE	emerged weeds	9	9	9	9	9	9	9	9	8	9	9	9	9	9	9	9	9	7	9	7/8	7	8	8[1]	9	8	9	E
	residual weed control	–	–	–	5	8	–	–	–	–	–	–	–	6	–	–	5	5	–	3	–	–	–	–	–	–	–	
glyphosate[3] + OPTILL + MERGE	emerged weeds	9	9	9	9	9	9	9	9	8	9	9^R	9	9	9	9	9	9^R	7	9	7/8	7	8	8[1]	9	8	9	E
	residual weed control	8	7	7	9^R	9^R	9	8	7	8	7	9^R	9	9^R	9	9^R	9^R	8^R	7	9	–	–	–	–	–	–	–	
glyphosate[3] + PROWL H2O	emerged weeds	9	9	9	9	9	9	9	9	9	9	8^R	9	9	9	9	9	9^R	8^R	9	7/8	5	8	8[1]	9	8	9	E
	residual weed control	9	9	9	9	9	9	–	5	–	–	–	–	7	–	–	8	–	–	–	–	–	–	–	–	–	–	

[1] A glyphosate rate of 1.8 kg/ha is required to achieve this level of control.

[2] Use only on certified soybean seed designated as "Roundup Ready" Soybean.

[3] Numerous products exist. See Table 11–7. Glyphosate Products Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant "Roundup Ready" Soybean, page 225, for a complete list of registered products.

TABLE 11–5. Soybean Herbicide Weed Control Ratings in Glyphosate Tolerant Soybeans (cont'd)

LEGEND: Numbers (0–9) = weed control ratings Crop tolerance ratings: E = Excellent, G = Good, F = Fair, P = Poor – = insufficient information available to make a rating
* = sold as a co-pack under this trade name
R = populations resistant to this herbicide exist in Ontario and won't be adequately controlled if present.

		Grasses								Annual Broadleaves											Perennials							
Trade Name	**Stage**	**barnyard grass**	**crabgrass**	**fall panicum**	**foxtail, giant**	**foxtail, green**	**foxtail, yellow**	**witchgrass**	**proso millet**	**buckwheat, wild**	**cocklebur**	**fleabane, Canada**	**lady's thumb**	**lamb's-quarters**	**mustards**	**nightshades, annual**	**pigweeds**	**ragweed, common**	**ragweed, giant**	**velvetleaf**	**bindweed, field**	**horsetail**	**milkweed**	**nutsedge**	**quackgrass**	**sow-thistle**	**thistle, Canada**	**Crop Tolerance**
Preplant Burndown Herbicides (cont'd)																												
glyphosate[3] + VALTERA	emerged weeds	9	9	9	9	9	9	9	9	9	9	8^R	8	9	9	9	9	9^R	9^R	9	7/8	5	8	8[1]	9	8	9	
	residual weed control	–	–	–	3	3	–	–	–	–	4	–	7	7	–	9	8	4	3	7	–	–	–	–	–	–	–	
PERFECTA + glyphosate[3]	emerged weeds	9	9	9	9	9	9	9	9	7	9	8^R	9	9	9	9	9^R	9^R	9	9	7/8	5	8	8[1]	9	8	9	G
	residual weed control	7	6	7	5	5	5	8	3	9	9	8	9	9	9	9	9	8	7	7	2	2	2	2	2	2	2	
STEP UP + glyphosate[3]	emerged weeds	9	9	9	9	9	9	9	9	9	9	8^R	9	9	9	9	9	9^R	9^R	9	7/8	5	8	8[1]	9	8	9	G
	residual weed control	3	3	3	5	5	5	3	–	9	9	8	9	9	9	9	9	8	7	7	2	2	2	2	2	2	2	
FIERCE + glyphosate	emerged weeds	9	9	9	9	9	9	9	9	9	9	9^R	9	9	9	9	9	9^R	9^R	9	7/8	5	8	8[1]	9	8	9	G
	residual weed control	9	9	–	9	9	9	–	–	8	5	8	8	9	9	9	9	7	5	7	–	–	–	–	–	–	–	
FLEXSTAR GT	emerged weeds	9	9	9	9	9	9	9	9	8	9	8^R	8	9	9	9	9	9	8^R	9	7/8	7	8	8[1]	9	8	9	E[2]
	residual weed control	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	8	8	–	–	–	–	–	–	–	–	–	
glyphosate[2,3]	emerged weeds	9	9	9	9	9	9	9	9	8	9	8^R	8	9	9	9	9	9^R	8^R	9	7/8	5	8	8[1]	9	8	9	E[2]

[1] A glyphosate rate of 1.8 kg/ha is required to achieve this level of control.

[2] Use only on certified soybean seed designated as "Roundup Ready" Soybean.

[3] Numerous products exist. See Table 11–7. Glyphosate Products Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant "Roundup Ready" Soybean, page 225, for a complete list of registered products.

TABLE 11–5. Soybean Herbicide Weed Control Ratings in Glyphosate Tolerant Soybeans (cont'd)

LEGEND: Numbers (0–9) = weed control ratings Crop tolerance ratings: E = Excellent, G = Good, F = Fair, P = Poor – = insufficient information available to make a rating
* = sold as a co-pack under this trade name
R = populations resistant to this herbicide exist in Ontario and won't be adequately controlled if present.

		Grasses								Annual Broadleaves											Perennials							
Trade Name	**Stage**	**barnyard grass**	**crabgrass**	**fall panicum**	**foxtail, giant**	**foxtail, green**	**foxtail, yellow**	**witchgrass**	**proso millet**	**buckwheat, wild**	**cocklebur**	**fleabane, Canada**	**lady's thumb**	**lamb's-quarters**	**mustards**	**nightshades, annual**	**pigweeds**	**ragweed, common**	**ragweed, giant**	**velvetleaf**	**bindweed, field**	**horsetail**	**milkweed**	**nutsedge**	**quackgrass**	**sow-thistle**	**thistle, Canada**	**Crop Tolerance**
Postemergence Tank-Mixes with residual weed control for "Roundup Ready" (glyphosate tolerant) varieties only																												
ASSIGNMENT*[2]	emerged weeds	9	9	9	9	9	9	9	9	8	9	8^R	8	9	9	9	9	9^R	8	9	7/8	5	8	8[1]	9	8	9	E[2]
	residual weed control	–	–	8	–	–	–	–	7	–	–	–	–	8^R	–	9^R	9^R	–	5	8	0	0	0	–	0	0	0	
GUARDIAN*[2]	emerged weeds	9	9	9	9	9	9	9	9	8	9	8^R	8	9	9	9	9	9^R	8^R	9	7/8	5	8	8	9	8	9	G[2]
	residual weed control	7	7	6	6^R	6^R	6	6	7	8	7	8^R	8	7^R	9	2	7^R	7^R	7^R	7	5	3	8	8	5	5	5	
glyphosate[2,3] + FIRSTRATE	emerged weeds	9	9	9	9	9	9	9	9	8	9	9^R	8	9	9	9	9	9^R	9^R	9	7/8	5	8	8[1]	9	8	9	E[2]
	residual weed control	0	0	0	0	0	0	0	0	7	9^R	9^R	–	2	9	2	2	9^R	9^R	9	–	2	–	–	2	7	7	

[1] A glyphosate rate of 1.8 kg/ha is required to achieve this level of control.

[2] Use only on certified soybean seed designated as "Roundup Ready" Soybean.

[3] Numerous products exist. See Table 11–7. Glyphosate Products Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant "Roundup Ready" Soybean, page 225, for a complete list of registered products.

Notes: Weed control ratings are given as 0–9 where 0 indicates no control and 9 indicates 90%–100% control under ideal conditions. Ratings are subjective values based on best available information and give general comparisons based on use as described in this guide. Under unfavourable conditions (e.g., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated. Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used. Always refer to the product label for more information on registered weed species, product uses and precautions.

TABLE 11–6. Additional Weed Control Ratings in Glyphosate Tolerant ("Roundup Ready") Soybean

LEGEND: Numbers (0–9) = weed control ratings
* = herbicides sold as a co-pack
Crop tolerance ratings: E = Excellent, G = Good, F = Fair, P = Poor
– = insufficient information available to make a rating

	Grasses		Annual and Biennial Broadleaf Weeds											Perennials		
Trade Name	**sandbur**	**vol. corn**	**beggarsticks, nodding**	**biennial wormwood**	**bur-cucumber**	**flower of an hour**	**prickly lettuce**	**spreading atriplex**	**three seeded mercury**	**waterhemp**	**wild carrot**	**wood-sorrel (oxalis)**	**violet, field**	**dandelion**	**horsenettle**	**wirestem muhly**
Postemergence Grass and Broadleaf Herbicides																
glyphosate	9	9[1]	8	8	8	9	8	7/8	8	9	8[2]	–	–	8[2]	8[2]	8
GUARDIAN* (glyphosate + CLASSIC)	9	9[1]	8	8	8	9	8	7/8	8	9	8[2]	–	–	8[3]	8[2]	8

[1] Glyphosate tolerant ("Roundup Ready") volunteer corn will not be controlled.

[2] Higher rates of glyphosate (i.e., 1.35–1.8 kg/ha) are required to achieve control of these perennial weeds.

[3] Dandelion must be less than 15 cm in diameter to achieve this level of control.

TABLE 11–7. Glyphosate Product Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant ("Roundup Ready") Soybean

LEGEND: a.i. = active ingredient ✓ = salt type — = not in product

	PRODUCT RATE					SALT TYPE		
Glyphosate Products	**0.9 kg/ha a.i.**	**1.35 kg/ha a.i.**	**1.8 kg/ha a.i.**	**Manufacturer**	**Rainfast**	**Dimethylamine**	**Isopropylamine**	**Potassium**
CREDIT PLUS (360 g/L)	1 L/acre	1.5 L/acre	2 L/acre	NUFARM	not specified	—	✓	—
CREDIT XTREME (540 g/L)	0.67 L/acre	1 L/acre	1.34 L/acre	NUFARM	not specified	—	✓	—
FACTOR 540 (540 g/L)	0.67 L/acre	1 L/acre	1.34 L/acre	IPCO	1 hour	—	—	✓
GLYFOS (360 g/L)	1 L/acre	1.5 L/acre	2 L/acre	CHEMINOVA	not specified	—	✓	—
MATRIX (480 g/L)	0.75 L/acre	1.13 L/acre	1.5 L/acre	IPCO	not specified	✓	—	—
MAVERICK III (480 g/L)	0.75 L/acre	1.13 L/acre	1.5 L/acre	DOW AGROSCIENCE	not specified	✓	—	—
MPOWER GLYPHOSATE (356 g/L)	1 L/acre	1.5 L/acre	2 L/acre	NEW AGCO INC.	not specified	—	✓	—
POLARIS (360 g/L)	1 L/acre	1.5 L/acre	2 L/acre	DUPONT	not specified	—	✓	
ROUNDUP ULTRA2 (540 g/L)	0.67 L/acre	1 L/acre	1.34 L/acre	MONSANTO	1 hour	—	—	✓
ROUNDUP WEATHERMAX (540 g/L)	0.67 L/acre	1 L/acre	1.34 L/acre	MONSANTO	1 hour	—	—	✓
SHARPSHOOTER PLUS (360 g/L)	1 L/acre	1.5 L/acre	2 L/acre	UAP	not specified	—	✓	—
TOUCHDOWN TOTAL (500 g/L)	0.72 L/acre	1.1 L/acre	1.44 L/acre	SYNGENTA	not specified	—	—	✓
TRAXION (500 g/L)	0.72 L/acre	1.1 L/acre	1.44 L/acre	SYNGENTA	not specified	—	—	✓
VANTAGE PLUS MAX (480 g/L)	0.75 L/acre	1.13 L/acre	1.5 L/acre	DOW AGROSCIENCE	not specified	✓	—	—

TABLE 11–8. Herbicide Treatment Rates for Glyphosate Tolerant ("Roundup Ready") Soybean

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Preplant Burndown Herbicides – Refer also to Chapter 6, Preplant & Postharvest Weed Control, page 91.			
· Non-selective herbicides such as glyphosate and GRAMAXONE are used to control emerged weeds prior to no-till planting. Tank-mixing of a residual herbicide with glyphosate or GRAMAXONE can be used to improve application efficiency with a "one pass" weed management program. · Refer to Chapter 6, Preplant & Postharvest Weed Control, page 91 for preplant application rates for glyphosate and GRAMAXONE. · It is also important to note that when targeting perennial weeds, the addition of a triazine-based herbicide (i.e., SENCOR, LOROX L) will reduce the level of activity achieved with glyphosate. Increasing the rate of glyphosate should overcome this antagonism.			
glyphosate (0.9 kg/ha) + imazepthapyr (0.1 kg/ha)	ASSIGNMENT (sold as a co-pack): RU WEATHERMAX (540 g/L) + PURSUIT (240 g/L)	1.67 L/ha (0.67 L/acre) + 420 mL/ha (168 mL/acre)	· See precautions for PURSUIT alone, page 207. · Some rotational cropping restrictions apply (see PHANTOM, PURSUIT or PHANTOM label and Table 4–4. Herbicide Crop Rotation and Soil pH Restrictions: Field Crops, page 74).
carfentrazone (13.2 g/ha) + 2,4-D (520 g/ha)	BLACKHAWK (sold as a co-pack): AIM EC (240 g/L) + 2,4-D ESTER 700 (660 g/L)	55 mL/ha (22.2 mL/acre) + 787 mL/ha (318.5 mL/acre)	· Apply a minimum of 7 days before planting soybean. · Apply to emerged giant ragweed. This treatment will not provide residual control of giant ragweed. · **Do NOT** use in sandy soils with less than 1% organic matter. Plant soybean seeds a minimum of 2.5 cm (1") deep. Adjust planter to ensure adequate coverage of planted seed. · **Do NOT** graze or cut treated crops for forage or hay until 67 days after application. · **Do NOT** enter or allow worker entry into treated areas during the restricted-entry interval (REI) of 12 hours.
chlorimuron-ethyl (9 g ai/ha) + metribuzin (412 g/ha) + glyphosate (900 g/ha)	CANOPY PRO (sold as a co-pack): CLASSIC GRANDE (25 DF) + TRICOR 75 DF + glyphosate (360 g/L)*	36 g/ha (14.4 g/acre) + 550 g/ha (220 g/acre) + 2.5 L/ha (1 L/acre)	· Apply as a Pre-Plant burndown up to 14 days before planting · Some rotational restrictions apply (see CLASSIC label and Table 4–4. Herbicide Crop Rotation and Soil pH Restrictions: Field Crops, page 74). · **Do NOT** use on sandy soils or on coarse soils with less than 2% organic matter. * Numerous products exist, refer to Table 11–7. Glyphosate Products Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant "Roundup Ready" Soybean, page 225 for a complete list of registered products.
glyphosate (0.9 kg/ha) + saflufenacil (25 g/ha)	ERAGON (70%) + glyphosate (360 g/L)* + MERGE	36 g/ha (14.4 g/acre) + 2.5–5 L/ha (1–2 L/acre) + 0.5% v/v	· Apply PP ONLY, from 21 days prior to planting up to the day of planting. · **Do NOT** use rates higher than 36 g/ha (14.4 g/acre) or crop injury may result. * Numerous products exist, refer to Table 11–7. Glyphosate Products Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant "Roundup Ready" Soybean, page 225 for a complete list of registered products.
	ERAGON LQ (342 g/L) + glyphosate (360 g/L)* + MERGE	73 mL/ha (29.5 mL/acre) + 2.5–5 L/ha (1–2 L/acre) + 0.5% v/v	

TABLE 11–8. Herbicide Treatment Rates for Glyphosate Tolerant ("Roundup Ready") Soybean (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Preplant Burndown Herbicides – Refer also to Chapter 6, Preplant & Postharvest Weed Control, page 91. (cont'd)			
fomesafen/glyphosate (1200 g/ha)	FLEXSTAR GT (67 g/L + 271 g/L)	3.5 L/ha (1.4 L/acre)	· Apply PP up to 7 days before planting and PRE. · **Do NOT** apply more than once per season and to any field in consecutive years. · Apply with Turbocharge at 0.25% v/v if weeds are emerged.
chlorimuron-ethyl (9 g ai/ha) + imazethapyr (75 g/ha) + glyphosate (900 g/ha)	FREESTYLE (sold as a co-pack): CLASSIC GRANDE (25 DF) + DUPONT IMAZETHAPYR (240 g/L) + glyphosate (360 g/L)*	 36 g/ha (14.4 g/acre) + 312 mL/ha (126 mL/acre) + 2.5 L/ha (1 L/acre)	· Apply PP up to 14 days before planting · Some rotational restrictions apply (refer to CLASSIC and PURSUIT in Table 4–4. Herbicide Crop Rotation and Soil pH Restrictions: Field Crops, page 74). * Numerous products exist, refer to Table 11–7. Glyphosate Products Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant "Roundup Ready" Soybean, page 225 for a complete list of registered products.
glyphosate (900 g/ha) + 2,4-D (528 g/ha)	glyphosate (360 g/L)* + 2,4-D ESTER 700 (660 g/L)	2.5–5 L/ha (1–2 L/acre) + 0.8 L/ha (0.32 L/acre)	· Apply a minimum of 7 days before planting soybean. · Apply to emerged giant ragweed. This treatment will not provide residual control of giant ragweed. · **Do NOT** use in sandy soils with less than 1% organic matter. Plant soybean seeds as deep as possible, but not less than 2.5 cm (1 in.). Adjust planter to ensure adequate coverage of planted seed. · **Do NOT** graze or cut treated crops for forage or hay until 67 days after application. · **Do NOT** enter or allow worker entry into treated areas during the restricted-entry interval (REI) of 12 hours. * Numerous products exist, refer to Table 11–7. Glyphosate Products Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant "Roundup Ready" Soybean, page 225 for a complete list of registered products.
glyphosate (0.9 kg/ha) + flumioxazin (71.4–107.1 g/ha)	glyphosate (360 g/L)* + VALTERA (51.1%)	2.5–5 L/ha (1–2 L/acre) + 140–210 g/ha (56–84 g/acre)	· Apply to coarse and medium textured soils. · Apply to soybeans prior to planting or within 3 days after planting but prior to soybean emergence. · Severe crop injury will result if applications are made to soybeans that have begun to crack through the soil surface or have emerged. · **Do NOT** within 100 metres of non-dormant pears. · **Do NOT** tank-mix with DUAL II MAGNUM, BOUNDARY or FRONTIER MAX. · Any tillage operation performed after application will reduce weed control. · Apply only **ONCE** per growing season. * Numerous products exist, refer to Table 11–7. Glyphosate Products Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant "Roundup Ready" Soybean, page 225 for a complete list of registered products.
glyphosate (900–1,800 g/ha) + saflufenacil/imazethapyr (216 g/ha)	glyphosate (360 g/L)* + OPTILL (68%) + MERGE	2.5–5 L/ha (1–2 L/acre) + 147 g/ha (59 g/acre) + 1 L/ha (0.4 L/acre)	· Apply PP ONLY, from 21 days prior to planting up to the day of planting. · Provides early-season weed control. Refer to glyphosate label for recommended rate. * Numerous products exist, refer to Table 11–7. Glyphosate Products Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant "Roundup Ready" Soybean, page 225 for a complete list of registered products.

TABLE 11–8. Herbicide Treatment Rates for Glyphosate Tolerant ("Roundup Ready") Soybean (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Preplant Burndown Herbicides – Refer also to Chapter 6, Preplant & Postharvest Weed Control, page 91. (cont'd)			
pendimethalin (1,000 g/ha) + glyphosate (900 g/ha)	PROWL H2O (455 g/L) + glyphosate (360 g/L)*	2.2 L/ha (0.89 L/acre) + 2.5 L/ha (1 L/acre)	· Apply PP. · Provides early-season weed control only. * Numerous products exist, refer to Table 11-7. Glyphosate Products Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant "Roundup Ready" Soybean, page 225 for a complete list of registered products.
glyphosate (0.9 kg/ha) + chlorimuron-ethyl (9 g/ha)	GUARDIAN (sold as a co-pack): POLARIS (360 g/L) + CLASSIC (25 DF)	2.5 L/ha (1 L/acre) + 36 g/ha (14 g/acre)	· Apply as a PP burndown. · Some rotational restrictions apply (see CLASSIC label and Table 4–4. Herbicide Crop Rotation and Soil pH Restrictions: Field Crops, page 74). · GUARDIAN is a co-pack of POLARIS + CLASSIC. · Some GUARDIAN co-pack's may contain TOUCHDOWN TOTAL instead of POLARIS. If you have a co-pack that contains TOUCHDOWN TOTAL, it should be applied at a rate of 1.8 L/ha (0.72 L/acre). · CLASSIC can only be applied once per growing season.
chlorimuron-ethyl (5.14%)/flumioxazin (40.6%) (80.5 g/ha) + glyphosate (0.9 kg/ha)	GUARDIAN PLUS II (sold as a co-pack): GUARDIAN PLUS WDG + POLARIS (360 g/L)	176 g/ha (70.4 g/acre) 2.5 L/ha (1 L/acre)	· Apply as a PP burndown. · Some rotational restrictions apply (see CLASSIC label and Table 4–4. Herbicide Crop Rotation and Soil pH Restrictions: Field Crops, page 74). · Refer to precautionary statements for VALTERA. · GUARDIAN PLUS is a co-pack of POLARIS + GUARDIAN PLUS WDG
flumioxazin (95.8 g/ha) + metribuzin (416 g/ha) + glyphosate (900 g/ha)	PERFECTA (sold as a co-pack): VALTERA (51.1%) + TRICOR (75%) + glyphosate (360 g/L)*	187.5 g/ha (75 g/acre) + 555 g/ha (220 g/acre) + 2.5 L/ha (1 L/acre)	· Apply PP or PRE but no longer than 3 days after planting. Applications made to planted soybeans where the soil has begun to crack or where beans are emerged will result in severe crop injury. · The risk of crop injury is minimized when Valtera is used on well drained soils and planted to a depth of 4 cm or more · When using no-till planters with coulters that incorporate the soil, weed control may be reduced, therefore applications should be done after planting, but within 3 days of planting. * Numerous products exist, refer to Table 11-7. Glyphosate Products Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant "Roundup Ready" Soybean, page 225 for a complete list of registered products.

TABLE 11–8. Herbicide Treatment Rates for Glyphosate Tolerant ("Roundup Ready") Soybean (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
flumioxazin (95.8 g/ha) + chlorimuron-ethyl (9 g/ha) + glyphosate (900 g/ha)	STEP-UP (sold as a co-pack): VALTERA (51.1%) + CHAPERONE (25%) + glyphosate (360 g/L)*	187.5 g/ha (75 g/acre) + 36 g/ha (14.4 g/acre) + 2.5 L/ha (1 L/acre)	· Apply PP or PRE but no longer than 3 days after planting. Applications made to planted soybeans where the soil has begun to crack or where beans are emerged will result in severe crop injury. · The risk of crop injury is minimized when Valtera is used on well drained soils and planted to a depth of 4 cm or more · When using no-till planters with coulters that incorporate the soil, weed control may be reduced, therefore applications should be done after planting, but within 3 days of planting. * Numerous products exist, refer to Table 11–7. Glyphosate Products Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant "Roundup Ready" Soybean, page 225 for a complete list of registered products.
Postemergence Grass and Broadleaf Herbicides – "Roundup Ready" (Glyphosate Tolerant) Varieties Only			
glyphosate (0.9–1.8 kg/ha)	glyphosate (360 g/L)*	2.5–5 L/ha (1–2 L/acre)	· For use **ONLY** with pedigreed (certified) soybean seed designated as "Roundup Ready" soybeans. · Apply between the first trifoliate leaf stage and the full flower stage of the soybeans. · Weeds are more easily controlled and weed competition avoided when applications are made when weeds are small, although weeds up to 25 cm tall will be controlled. · Apply when milkweed, perennial sow-thistle and Canada thistle are 15–60 cm. · Apply when nutsedge is 5–15 cm in height and at the high rate. · A second application may be made for later flushes emerging after the initial application. · Use 100–200 L/ha (40–80 L/acre) water. * Numerous products exist, refer to Table 11–7. Glyphosate Products Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant "Roundup Ready" Soybean, page 225 for a complete list of registered products.
	other glyphosate products	See Table 11–6, page 224.	
glyphosate (0.9 + 0.9 kg/ha)	glyphosate (360 g/L)*	2.5 + 2.5 L/ha (1 + 1 L/acre)	· For use **ONLY** with pedigreed (certified) soybean seed designated as "Roundup Ready" soybeans. · Sequential applications are desirable when there are perennial weeds emerging over a long period of time (i.e. sow-thistle, Canada thistle). · For best results, apply the second application 14 days after the first. · Apply when milkweed, perennial sow-thistle and Canada thistle are 15–60 cm and nutsedge is 5–15 cm in height and actively growing for best results. * Numerous products exist, refer to Table 11–7. Glyphosate Products Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant "Roundup Ready" Soybean, page 225 for a complete list of registered products.
	other glyphosate products	See Table 11–6, page 224.	

TABLE 11–8. Herbicide Treatment Rates for Glyphosate Tolerant ("Roundup Ready") Soybean (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Postemergence Tank-Mixes for Residual Weed Control – "Roundup Ready" (Glyphosate Tolerant) Varieties Only			
glyphosate (0.9–1.8 kg/ha) + imazepthapyr (0.038–0.05 kg/ha)	ASSIGNMENT (sold as a co-pack): RU WEATHERMAX (540 g/L) + PURSUIT (240 g/L)	1.67–3.33 L/ha (0.67–1.34 L/acre) + 160–210 mL/ha (65–85 mL/acre)	· For use **ONLY** with pedigreed (certified) soybean seed designated as "Roundup Ready" soybeans. · Apply up to the 3rd trifoliate stage of soybean. · Use **ONLY** once per season. · Other glyphosate products can be tank-mixed with PURSUIT or PHANTOM or NU-IMAGE to make up the same treatment. · Some rotational cropping restrictions apply (see PHANTOM or PURSUIT or NU-IMAGE label and Table 4–4. Herbicide Crop Rotation and Soil pH Restrictions: Field Crops, page 74).
fomesafen/glyphosate (1200 g/ha)	FLEXSTAR GT	3.5 L/ha (1.4 L/acre)	· For use **ONLY** with pedigreed (certified) soybean seed designated as "Roundup Ready" soybeans. · Apply between the 1–2 trifoliate stage of soybean. · Provides residual control of common ragweed and redroot pigweed. · If weeds are large or under stress then the addition of TURBOCHARGE at 0.25% v/v is required. · **Do NOT** apply to soybeans within 90 days of harvest.
glyphosate (0.45–0.9 kg/ha) + cloransulam-methyl (17.5 g/ha)	glyphosate (360 g/L)* + FIRSTRATE (84 WG)	1.25–2.5 L/ha (0.5–1 L/acre) + 20.8 g/ha (8.5 g/acre)	· For use **ONLY** with pedigreed (certified) soybean seed designated as "Roundup Ready" soybeans. · The addition of FIRSTRATE will provide residual control of common ragweed, velvetleaf, cocklebur, jimsonweed and giant ragweed. · **Do NOT** apply to soybeans within 65 days of harvest. * Numerous products exist, refer to Table 11–7. Glyphosate Products Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant "Roundup Ready" Soybean, page 225 for a complete list of registered products.
glyphosate (0.9–1.8 kg/ha) + imazethapyr (0.038–0.05 kg/ha)	glyphosate (360 g/L)* + PURSUIT (240 g/L)	2.5–5 L/ha (1 L/acre) + 160–210 mL/ha (65–85 mL/acre)	· For use **ONLY** with pedigreed (certified) soybean seed designated as "Roundup Ready" soybeans. · Apply up to the 3rd trifoliate stage of soybean. · Use only **ONCE** per season. · Some rotational cropping restrictions apply (see PURSUIT label and Table 4–4. Herbicide Crop Rotation and Soil pH Restrictions: Field Crops, page 74). * Numerous products exist, refer to Table 11–7. Glyphosate Products Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant "Roundup Ready" Soybean, page 225 for a complete list of registered products.
	glyphosate (360 g/L)* + PHANTOM (240 g/L)	2.5–5 L/ha (1 L/acre) + 160–210 mL/ha (65–85 mL/acre)	

TABLE 11–8. Herbicide Treatment Rates for Glyphosate Tolerant ("Roundup Ready") Soybean (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Postemergence Tank-Mixes for Residual Weed Control – "Roundup Ready" (Glyphosate Tolerant) Varieties Only (cont'd)			
glyphosate (0.9 kg/ha) + chlorimuron-ethyl (9 g/ha)	GUARDIAN (sold as a co-pack): POLARIS (360 g/L) + CLASSIC (25 DF)	2.5 L/ha (1 L/acre) + 36 g/ha (14 g/acre)	· For use **ONLY** with pedigreed (certified) soybean seed designated as "Roundup Ready" soybeans. · Apply up to the 3rd trifoliate stage of soybean. · Use **ONLY** once per season. · GUARDIAN is a co-pack of POLARIS + CLASSIC. · Some GUARDIAN PLUS co-pack's may contain TOUCHDOWN TOTAL instead of POLARIS. If you have a co-pack that contains TOUCHDOWN TOTAL, it should be applied at a rate of 1.8 L/ha (0.72 L/acre). · Some rotational cropping restrictions apply (see CLASSIC label and Table 4–4. Herbicide Crop Rotation and Soil pH Restrictions: Field Crops, page 74).
Tank-Mixes to Address "Roundup Ready" Volunteer Corn in "Roundup Ready" (Glyphosate Tolerant) Soybean Varieties			
glyphosate (0.9–1.8 kg/ha) + quizalofop-p-ethyl (0.024 kg/ha)	glyphosate (360 g/L)* + ASSURE II (96 g/L) glyphosate (360 g/L)* + YUMA GL (96 g/L)	2.5–5 L/ha (1–2 L/acre) + 0.25 L/ha (0.1 L/acre)	· For use **ONLY** with pedigreed (certified) soybean seed designated as "Roundup Ready" soybeans. · The addition of ASSURE II is to control volunteer "Roundup Ready" corn. · Apply to volunteer corn up to 30 cm (12 in.) in height. · **Do NOT** apply to soybeans within 80 days of harvest. · SUREMIX may or may not be added to this tank-mix. If adding SUREMIX do so at a rate of 5 L/1,000 L water. · Volunteer "ENLIST" corn **WILL NOT** be controlled by this herbicide. * Numerous products exist, refer to Table 11–7. Glyphosate Products Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant "Roundup Ready" Soybean, page 225 for a complete list of registered products.
glyphosate (0.9–1.8 kg/ha) + fluazifop-p-butyl (0.075 kg/ha)	glyphosate (360 g/L)* + VENTURE (125 g/L)	2.5–5 L/ha (1–2 L/acre) + 0.6 L/ha (0.243 L/acre)	· For use **ONLY** with pedigreed (certified) soybean seed designated as "Roundup Ready" soybeans. · The addition of VENTURE is needed to control volunteer "Roundup Ready" corn. · Apply to volunteer corn at the 2–5 leaf stage. · Volunteer "ENLIST" corn **WILL NOT** be controlled by this herbicide. * Numerous products exist, refer to Table 11–7. Glyphosate Products Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant "Roundup Ready" Soybean, page 225 for a complete list of registered products.
Preharvest – Refer to the Preharvest Treatments listed for Conventional (non GMO) Soybeans, page 218.			

Glufosinate Tolerant ("Liberty Link") Soybean

Weed Management Strategies for Glufosinate Tolerant Soybean

Strategies for weed management in glufosinate tolerant soybeans are similar to those outlined for glyphosate tolerant soybeans on "Glyphosate Tolerant ("Roundup Ready") Soybean" on page 219

NOTES: Weed control ratings are given as 0–9 where 0 indicates no control and 9 indicates 90%–100% control under ideal conditions. Ratings are subjective values based on best available information and give general comparisons based on use as described in this guide. Under unfavourable conditions (e.g., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated. Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used. Always refer to the product label for more information on registered weed species, product uses and precautions.

TABLE 11–9. Soybean Herbicide Weed Control Ratings in Glufosinate Tolerant ("Liberty Link") Soybeans

LEGEND: Numbers (0–9) = weed control ratings Crop tolerance ratings: E = Excellent, G = Good, F = Fair, P = Poor – = insufficient information available to make a rating
R = populations resistant to this herbicide exist in Ontario and won't be adequately controlled if present.

		Grasses								**Annual Broadleaves**											**Perennials**							
Trade Name	**Weed Stage**	**barnyard grass**	**crabgrass**	**fall panicum**	**foxtail, giant**	**foxtail, green**	**foxtail, yellow**	**witchgrass**	**proso millet**	**buckwheat, wild**	**cocklebur**	**fleabane, Canada**	**lady's thumb**	**lamb's-quarters**	**mustards**	**nightshades, annual**	**pigweeds**	**ragweed, common**	**ragweed, giant**	**velvetleaf**	**bindweed, field**	**horsetail**	**milkweed**	**nutsedge**	**quackgrass**	**sow-thistle**	**thistle, Canada**	**Crop Tolerance**
Postemergence Grass and Broadleaf Herbicides and Tank-Mixes – "Liberty Link" (glufosinate tolerant) varieties only																												
LIBERTY	emerged weeds	9	9	9	9	9	8/9	9	9	8	9	7	8/9	8	9	9	9	9	6	8	6	6	–	6	6/7	8	7	E
LIBERTY + BASAGRAN FORTÉ	emerged weeds	9	9	9	9	9	8/9	9	9	8	9	7	9	8	9	9	9	9	6	8	6	6	–	8	6/7	8	7	G
LIBERTY + FIRSTRATE	emerged weeds	9	9	9	9	9	8/9	9	9	8	9	9	8/9	9	9	9	9	9	9^{R}	8	6	6	–	6	6/7	8	7	E
	residual weed control	0	0	0	0	0	0	0	0	–	9	9	–	9^{R}	–	2	9^{R}	9^{R}	9^{R}	9	–	2	–	–	2	6	–	
LIBERTY + PURSUIT	emerged weeds	9	9	9	9	9	9	9	9	8	9	7	9	8	9	9	9	9	6	8	6	6	–	7	6/7	8	7	G
	residual weed control	8	7	7	9^{R}	9^{R}	9	8	7	8	7^{R}	2	9	8^{R}	9	9^{R}	9^{R}	8^{R}	6^{R}	9	2	2	2	4	2	2	2	

TABLE 11–10. Herbicide Treatment Rates for Glufosinate Tolerant ("Liberty Link") Soybean

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Preplant Burndown Herbicides – Refer also to Chapter 6, Preplant & Postharvest Weed Control, page 91			
Non-selective herbicides such as glyphosate and GRAMAXONE are used to control emerged weeds prior to no-till planting. Tank-mixing of a residual herbicide with glyphosate or GRAMAXONE can be used to improve application efficiency with a "one pass" weed management program. Refer to Chapter 6, Preplant & Postharvest Weed Control, page 91 for preplant application rates for glyphosate and GRAMAXONE. It is also important to note that when targeting perennial weeds, the addition of a triazine-based herbicide (i.e., SENCOR, LOROX L) will reduce the level of activity achieved with glyphosate. Increasing the rate of glyphosate should overcome this antagonism.			
One Pass Strategies			
glufosinate ammonium (0.5 kg/ha)	LIBERTY 200 SN (200 g/L)	2.5 L/ha (1 L/acre)	• Use **ONLY** on soybean varieties that are tolerant to LIBERTY 200 SN. • LIBERTY 200 SN can be applied from the cotyledon to flowering stage of soybean. • LIBERTY 200 SN is a contact herbicide and has no residual activity. • Ammonium sulphate can be applied at 6 L/ha (2.4 L/acre) (liquid) or 3.3 kg/ha (1.3 kg/acre) (dry) for improved control of specific weeds. • **Do NOT** add oil or any other surfactants.
glufosinate ammonium (0.5 kg/ha) + bentazon (0.84 kg/ha)	LIBERTY 200 SN (200 g/L) + BASAGRAN FORTÉ (480 g/L)	2.5 L/ha (1 L/acre) + 1.75 L/ha (0.7 L/acre)	• Use **ONLY** on soybean varieties that are tolerant to LIBERTY 200 SN. • This tank-mix can be applied from the cotyledon to flowering stage of soybean. • This tank-mix consists of contact herbicides that have no residual activity. • Weeds should be targeted when small and actively growing (8 leaf stage or less).
glufosinate ammonium (0.5 kg/ha) + cloransulam-methyl (17.5 g/ha)	LIBERTY 200 SN (200 g/L) + FIRSTRATE (84 WG)	2.5 L/ha (1 L/acre) + 20.8 g/ha (8.5 g/acre)	• Use **ONLY** on soybean varieties that are tolerant to LIBERTY 200 SN. • This tank-mix can be applied from the cotyledon to flowering stage of soybean. • The addition of FIRSTRATE is for residual activity of labeled broadleaf weeds. • Weeds should be targeted when small and actively growing (6 leaf stage or less).
glufosinate ammonium (0.5 kg/ha) + imazethapyr (0.075 kg/ha)	LIBERTY 200 SN (200 g/L) + PURSUIT (240 g/L)	2.5 L/ha (1 L/acre) + 0.312 L/ha (0.126 L/acre)	• Use **ONLY** on soybean varieties that are tolerant to LIBERTY 200 SN. • This tank-mix can be applied from the cotyledon to flowering stage of soybean. • The addition of PURSUIT is for residual activity of labeled grass and broadleaf weeds. • Weeds should be targeted when small and actively growing (8 leaf stage or less).
Two Pass Strategies			
glufosinate ammonium (0.5 kg/ha) followed by glufosinate ammonium (0.4 kg/ha)	LIBERTY 200 SN (200 g/L) followed by LIBERTY 200 SN (200 g/L)	2.5 L/ha (1 L/acre) followed by 2 L/ha (0.8 L/acre)	• Use **ONLY** on soybean varieties that are tolerant to LIBERTY 200 SN. • LIBERTY 200 SN can be applied from the cotyledon to flowering stage of soybean. • Ideally, the first application is made between the uni-foliate and 2nd trifoliate stage of soybean, the second application is made between the 4th and 6th trifoliate stage of soybean.

Weed Control for Enlist Soybeans

NOTES: Weed control ratings are given as 0–9 where 0 indicates no control and 9 indicates 90%–100% control under ideal conditions. Ratings are subjective values based on best available information and give general comparisons based on use as described in this guide. Under unfavourable conditions (e.g., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated. Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used. Always refer to the product label for more information on registered weed species, product uses and precautions.

TABLE 11–11. Weed Control for Enlist Soybeans

LEGEND: Numbers (0–9) = weed control ratings Crop tolerance ratings: E = Excellent, G = Good, F = Fair, P = Poor

	Grasses									Annual Broadleaves												Perennials							
Trade Name	barnyard grass	crabgrass, smooth	crabgrass, large	fall panicum	foxtail, giant	foxtail, green	foxtail, yellow	witchgrass	proso millet	buckwheat, wild	cocklebur	corn spurry	fleabane, Canada	lady's thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed, common	ragweed, giant	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada	Crop Tolerance
Postemergence Herbicides for Enlist Hybrids Only																													
ENLIST DUO	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	8	7	9	8	9	9	9	E

TABLE 11–12. Herbicide Treatment Rates for Enlist Soybeans

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Postemergence Herbicides for Enlist Soybean Varieties Only			
2,4-D choline salt (194 g/L) glyphosate (204 g/L)	ENLIST DUO	2.9–4.3 L/ha (1.17–1.74 L/acre)	· Apply POST up to the full flowering stage (R2) · Make 1–2 applications with a minimum of 12 days between applications. · Two applications may be necessary for control of perennial weeds or late weed flushes that emerged after the initial application. · Apply as a coarse to extremely coarse spray (ASABE S-572 Standard). · Re-Entry interval is 48 hours after application. · Do not apply more than two post emergent applications per use season · Do not apply more than 8.6 L/ha of ENLIST DUO per use season. · Read and follow the DAS Stewardship Program (http://www.traitstewardship.com) that accompanies the use of soybean seed containing the DAS-40278-9 gene.

GLYPHOSATE AND DICAMBA TOLERANT ("ROUNDUP READY 2 XTEND™") SOYBEAN

Weed Management Strategies in Roundup Ready 2 Xtend Soybeans

Weed Management Strategies in Roundup Ready 2 Xtend Soybeans

The chosen herbicide program and timing of glyphosate + dicamba applications should be tailored to the target weed species and method of tillage in a given field. Always consider using additional herbicide modes of action or traditional residual herbicides as needed.

No-till/conservation tillage:

Use the high label rate of dicamba with glyphosate when applied pre-plant or preemergence. The high label rate of dicamba provides short term residual weed control of broadleaf weeds to assist in early weed removal.

Early weed removal and short term residual weed control with dicamba applied early at the high label rate provides the best chance to improve soybean yield compared to glyphosate only applications[1].

Conventional tillage:

Start clean with tillage and apply dicamba with glyphosate to small weeds (<10 cm or 4 inches), as the first in-crop herbicide application (emergence to 2nd trifoliate leaf stage).

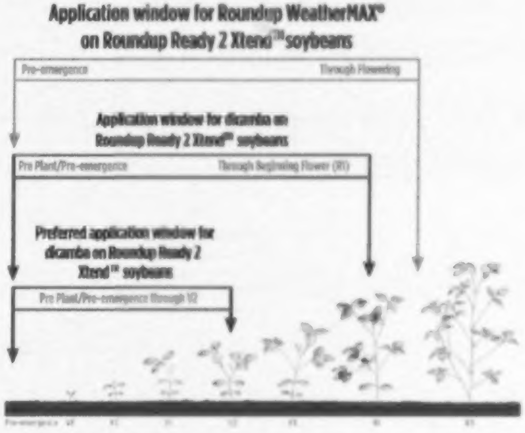
In fields with historically high weed pressure, a pre-emergence residual herbicide should be applied to minimize risk of yield loss due to early season weed competition.

Management of Glyphosate-Resistant Weeds

In Monsanto Canada and University of Guelph trials, dicamba has provided excellent control of giant ragweed, Canada fleabane and common ragweed[2].

Where glyphosate-resistant weeds exist, include an additional, effective mode of action in a tank mix or in sequential applications.

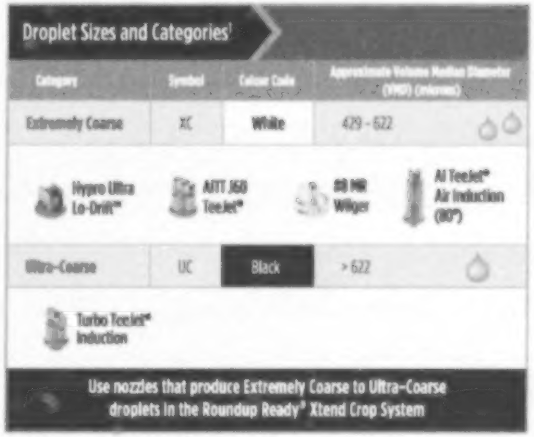
Window of Application


Application window for Roundup WeatherMAX® on Roundup Ready 2 Xtend™ soybeans
Pre-emergence
Through Flowering
Application window for dicamba on Roundup Ready 2 Xtend™ soybeans
Pre Plant/Pre-emergence
Through Beginning Flower (R1)
Preferred application window for dicamba on Roundup Ready 2 Xtend™ soybeans
Pre Plant/Pre-emergence through V2
Pre-emergence
VE
VC
V1
V2
V3
R1
R3

2nd pass application is restricted for control of glyphosate-resistant weeds

Application Requirements[3]

Choose nozzles that produce large droplets to minimize drift potential (examples below).



Droplet Sizes and Categories[1]

Category	Symbol	Colour Code	Approximate Volume Median Diameter (VMD) (microns)
Extremely Coarse	XC	White	429 - 622
Ultra-Coarse	UC	Black	> 622

Hypro Ultra Lo-Drift™
AITTJ60 TeeJet®
SR MR Wilger
AI TeeJet® Air Induction (80°)
Turbo TeeJet® Induction

Use nozzles that produce Extremely Coarse to Ultra-Coarse droplets in the Roundup Ready® Xtend Crop System

[1]ASABE (American Society of Agricultural & Biological Engineers) Standard 572 [illegible]

- Apply when wind speed is between 3–15 km/h.
- Apply in minimum carrier volume of 100 L/ha (10 GPA).
- Select a ground speed below 25 km/h.
- Set boom to lowest effective height over the target.

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1 2008-2014 Monsanto Canada and University of Guelph field trials (n = 39).

2 giant ragweed (2010-2013) at 5 locations; Canada fleabane (2011-2013) at 6 locations; common ragweed (2013-2015) at 4 locations

3 Refer to dicamba herbicide label for more detailed application requirements.

ALWAYS READ AND FOLLOW PESTICIDE LABEL DIRECTIONS. Roundup Ready 2 Xtend™, Roundup Ready®, Roundup WeatherMAX®, Roundup®, VaporGrip™ and XtendiMax™ are trademarks of Monsanto Technology LLC, Monsanto Canada, Inc. licensee. ©2015 Monsanto Canada Inc.

GLYPHOSATE AND DICAMBA TOLERANT ("ROUNDUP READY 2 XTEND™") SOYBEAN

Weed Management Strategies in Roundup Ready 2 Xtend Soybeans

NOTES: Weed control ratings are given as 0–9 where 0 indicates no control and 9 indicates 90%–100% control under ideal conditions. Ratings are subjective values based on best available information and give general comparisons based on use as described in this guide. Under unfavourable conditions (e.g., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated. Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used. Always refer to the product label for more information on registered weed species, product uses and precautions.

TABLE 11–13. Glyphosate and dicamba Tolerant ("Roundup Ready 2 Xtend") Soybean Herbicide Weed Control Ratings

LEGEND: Numbers (0–9) = weed control ratings
* sold as a co-pack under this trade name
Crop tolerance ratings: E = Excellent, G = Good, F = Fair, P = Poor
R = populations resistant to this herbicide exist in Ontario and won't be adequately controlled if present.
– = insufficient information available to make a rating

		Annual Grasses									Annual Broadleaves												Perennials							
Trade Name	**Weed Stage**	**barnyard grass**	**smooth crabgrass**	**large crabgrass**	**fall panicum**	**foxtail, giant**	**foxtail, green**	**foxtail, yellow**	**witchgrass**	**proso millet**	**buckwheat, wild**	**cocklebur**	**corn spurry**	**fleabane, Canada**	**lady's thumb**	**lamb's-quarters**	**mustards**	**nightshades, annual**	**pigweeds**	**ragweed, common**	**ragweed, giant**	**velvetleaf**	**bindweed, field**	**horsetail**	**milkweed**	**nutsedge**	**quackgrass**	**sow-thistle**	**thistle, Canada**	**Crop Tolerance**
Soil Applied Broadleaf Herbicides (Preemergence timing only)																														
BANVEL II or XTENDIMAX[2]	residual weed control	0	0	0	0	0	0	0	0	0	8	6	8	8	9	9	6	9	9	9	7	8	2	0	0	0	0	2	2	E
Postemergence Herbicides for Glyphosate andDicamba Tolerant Varieties Only																														
BANVEL II or XTENDIMAX[2]	emerged weed control	0	0	0	0	0	0	0	0	0	8	6	8	8	9	9	6	9	9	9	7	8	2	0	0	0	0	2	2	E
glyphosate (540 g/L)[2,3]	emerged weed control	9	9	9	9	9	9	9	9	9	8	9	9	9[R]	8	9	9	9	9	9[R]	9[R]	9	7/8	5	8	8[1]	9	8	9	E
One Pass Postemergence Tank-Mixes with Residual Weed Control for Glyphosate andDicamba Tolerant Varieties Only																														
BANVEL II or XTENDIMAX[2] + glyphosate[2,3]	emerged weed control	9	9	9	9	9	9	9	9	9	8	9	9	8	8	9	9	9	9	9	7	9	7/8	5	8	8[1]	9	8	9	E
	residual weed control	0	0	0	0	0	0	0	0	0	8	6	8	8	9	9	6	9	9	9	7	8	2	0	0	0	0	2	2	

[1] A glyphosate rate of 1.8 kg/ha is required to achieve this level of control.

[2] Use only on certified soybean seed designated as "Roundup Ready 2 Xtend" Soybean.

[3] Numerous products exist. See Table 11–7. Glyphosate Products Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant "Roundup Ready" Soybean, page 225, for a complete list of registered products.

TABLE 11–14. Herbicide Treatment Rates for Roundup Ready 2 Xtend Soybeans

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
dicamba (288–600 g/ha) + glyphosate (900–2500 g/ha)	XtendiMax (350 g/L) + Roundup Weathermax (540 g/L)	0.82–1.71 L/ha (0.33–0.68 L/acre) + 1.67–4.67 L/ha (0.67–1.89 L/acre)	· For use ONLY with certified soybean seed designated as "Roundup Ready 2 Xtend" soybeans · Apply PP or PRE and/or POST to the crop once or twice up to the early flower stage (R1) by ground only. · The highest rate of dicamba (XtendiMax, Banvel II) can only be used once in a season and should be applied PP, PRE or early POST (2nd trifoliate growth stage). · Use the highest rate of dicamba (XtendiMax, Banvel II) to enhance burndown activity and provide short term residual weed control. · **Do NOT** apply more than 3.36 L/ha of XtendiMax with VaporGrip Technology or 2.45 L/ha of Banvel II in a single growing season. · **Do NOT** use with AMS (ammonium sulfate) or AMS-containing adjuvants, water conditioners or buffering agents that acidify the spray solution, or sprayable fluid fertilizers. · Use only spray nozzles operated at the nozzle manufacturer's recommended pressure to produce extremely coarse to ultra coarse spray droplets (ASABE S-572.1). · Refer to the XtendiMax with VaporGrip Technology herbicide label for more detailed application requirements regarding spray drift management.
dicamba (288–600 g/ha) + glyphosate (900–2500 g/ha)	Banvel II (480 g/L) + glyphosate (360 g/L)*	0.6–1.25 L/ha (0.24–0.5 L/acre) + 2.5–6.9 L/ha (1–2.8 L/acre)	

NOTES: Herbicide performance is improved when a product is applied at the appropriate rate and at the appropriate crop and weed stage. This table provides information on ideal crop stage, maximum leaf stage of the weed and corresponding rate (if a product rate range exists) that a product must be applied to minimize performance issues.

TABLE 11–15. Maximum Weed Stage for Application of Postemergence Soybean Herbicides — Annual Grasses

LEGEND: Numbers (0–9) = leaf stages
NR = no labelled restriction on crop stage
Leaf stage abbreviation: ET – early tillering of grasses
– = not on the product label

Trade Name	Application Window (soybean stage)	Weed Stage								
		barnyard grass	crabgrass	fall panicum	foxtail, green	foxtail, yellow	witchgrass	proso millet	volunteer corn	volunteer wheat
ASSURE II/YUMA GL	NR	2 leaf–ET	–	2 leaf–ET	2 leaf–ET	2 leaf–ET	2 leaf–ET	2 leaf–ET	2–6 leaf	2 leaf–ET
EXCEL SUPER	NR	1–6 leaf	1–6 leaf	1–6 leaf	1–6 leaf	1–6 leaf	1–6 leaf	1–6 leaf	1–6 leaf	–
POAST ULTRA	NR	1–6 leaf	1–6 leaf	1–6 leaf	1–6 leaf	1–6 leaf	1–6 leaf	1–6 leaf	1–6 leaf	–
SELECT, ARROW	NR	2–6 leaf	2–6 leaf	2–6 leaf	2–6 leaf	2–6 leaf	2–6 leaf	2–6 leaf	2–6 leaf	2–4 leaf
VENTURE L	NR	2–5 leaf	2–5 leaf	2–5 leaf	2–4 leaf	2–4 leaf	2–5 leaf	2–4 leaf	2–4 leaf	2–5 leaf
CLEANSWEEP	unifoliate–2-trifoliate	6 leaf	–	–	4 leaf	4 leaf	–	–	–	–

[1] Use only on "Liberty Link" varieties.

[2] Use only on "Roundup Ready" varieties. See Table 11–7. Glyphosate Products Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant "Roundup Ready" Soybean, page 225, for a complete list of registered products.

TABLE 11–15. Maximum Weed Stage for Application of Postemergence Soybean Herbicides — Annual Grasses

LEGEND: Numbers (0–9) = leaf stages   Leaf stage abbreviation: ET – early tillering of grasses
NR = no labelled restriction on crop stage   – = not on the product label

Trade Name	Application Window (soybean stage)	Weed Stage								
		barnyard grass	crabgrass	fall panicum	foxtail, green	foxtail, yellow	witchgrass	proso millet	volunteer corn	volunteer wheat
PURSUIT or PHANTOM or NU-IMAGE	NR	6 leaf	–	–	4 leaf	4 leaf	2 leaf	–	–	–
LIBERTY[1]	until flowering	5 leaf	5 leaf	4 leaf	5 leaf	4 leaf	4 leaf	5 leaf	–	–
glyphosate[2]	until flowering	8 leaf	8 leaf	8 leaf	8 leaf	8 leaf	8 leaf	8 leaf	8 leaf	8 leaf

[1] Use only on "Liberty Link" varieties.

[2] Use only on "Roundup Ready" varieties. See Table 11–7. Glyphosate Products Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant "Roundup Ready" Soybean, page 225, for a complete list of registered products.

TABLE 11–16. Maximum Weed Stage for Application of Postemergence Soybean Herbicides — Annual Broadleaves

LEGEND: Numbers (0–9) = leaf stages   NR = no labelled restriction on crop stage   – = not on the product label

Trade Name	Application Window (soybean stage)	Weed Stage										
		buckwheat, wild	cocklebur	jimsonweed	lady's-thumb	lamb's-quarters	wild mustard	nightshade	pigweed	common ragweed	giant ragweed	velvetleaf
BASAGRAN	unifoliate–2-trifoliate	–	10 leaf	10 leaf	10 leaf	8 leaf	10 leaf	–	4 leaf	6 leaf	4 leaf	6 leaf
BLAZER	1–3-trifoliate	–	4 leaf	10 leaf	8 leaf	2 leaf	10 leaf	6 leaf	4–6 leaf	8 leaf	–	–
CLASSIC/CHAPERONE	1–3-trifoliate	–	–	–	–	–	–	–	2–8 leaf	2–6 leaf	–	2–4 leaf
CLEANSWEEP	unifoliate–2-trifoliate	–	6 leaf	–	6 leaf	6 leaf	6 leaf	4 leaf	12 leaf	6 leaf	–	4 leaf
FIRSTRATE	prior–flowering	–	4–8 leaf	2–4 leaf	–	–	–	–	–	4–8 leaf	4–6 leaf	2–4 leaf
PINNACLE SG	1-trifoliate–flowering	–	–	–	2–8 leaf	2–6 leaf	2–8 leaf	–	2–8 leaf	–	–	2–4 leaf
PURSUIT or PHANTOM or NU-IMAGE	NR	2 leaf	2 leaf	–	–	–	2 leaf	2 leaf	12 leaf	2 leaf	–	8 leaf
REFLEX	1–2-trifoliate	–	4 leaf	–	4 leaf	3 leaf[1]	4 leaf	4 leaf	4 leaf	4 leaf	–	3 leaf[1]
LIBERTY[2]	until flowering	4 leaf	4 leaf	–	6 leaf	6 leaf	4 leaf	5 leaf	6 leaf	5 leaf	–	4 leaf
glyphosate[3]	until flowering	8 leaf	8 leaf	8 leaf	8 leaf	8 leaf	8 leaf	8 leaf	8 leaf	8 leaf	–	–

[1] Suppression only.

[2] Use only on "Liberty Link" varieties.

[3] Use only on "Roundup Ready" varieties. See Table 11–7. Glyphosate Products Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant "Roundup Ready" Soybean, page 225, for a complete list of registered products.

TABLE 11–17. Maximum Weed Stage for Application of Postemergence Soybean Herbicides — Perennials

LEGEND: Numbers (0–9) = leaf stages NR = no labelled restriction on crop stage – = not on the product label

Trade Name	Application Window (soybean stage)	Weed Stage		
		quackgrass control	**quackgrass suppression**[2]	**wirestem muhly**
ASSURE II/YUMA GL	NR	2–6 leaf 750 mL/ha (300 mL acre)	2–6 leaf 500 mL/ha (200 mL/acre)	–
POAST ULTRA	NR	–	1–3 leaf 1125 mL/ha (450 mL/acre)	–
SELECT, ARROW	NR	2–6 leaf 375 mL/ha (150 mL/acre)	2–6 leaf 375 mL/ha (150 mL/acre)	–
VENTURE L	NR	3–5 leaf 2 L/ha (800 mL/acre)	3–5 leaf 2 L/ha (800 mL/acre)	3–5 leaf 2 L/ha (800 mL/acre)
LIBERTY[1]	until flowering	–	4 leaf	–
glyphosate[2]	until flowering	4 leaf+	–	–

[1] Use only on "Liberty Link" varieties.

[2] Use only on "Roundup Ready" varieties. See Table 11–7. Glyphosate Products Rates, Manufacturer, Rainfast and Salt Type Labeled for Use on Glyphosate Tolerant "Roundup Ready" Soybean, page 225, for a complete list of registered products.

12. OTHER FIELD CROPS

NOTES: Weed control ratings are given as 0–9 where 0 indicates no control and 9 indicates 90%–100% control under ideal conditions. Ratings are subjective values based on best available information and give general comparisons based on use as described in this guide. Under unfavorable conditions (e.g., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated. Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used. Please see product label for more information on registered weed species, product uses and precautions.

TABLE 12–1. Canola, Flax, Hemp, Millet, Mustard, Peanut, Sorghum, Sunflower Herbicide Weed Control Ratings

LEGEND: Numbers (0–9) = weed control ratings – = insufficient information available to make a rating ✓ = can be used on this crop x = not indicated for use on this crop
R = populations resistant to this herbicide exist in Ontario and won't be adequately controlled if present.

	Crop							Annual Grasses																					Perennials						
Trade Name	canola	flax	hemp	mustard	peanuts	sorghum and millet	sunflowers	barnyard grass	crabgrass	fall panicum	foxtails	witchgrass	proso millet	wild oats	vol. corn	vol. cereals	buckwheat, wild	cocklebur	fleabane, Canada	lady's thumb	lamb's-quarters	wild mustard	nightshades, annual	pigweed	ragweed, common	ragweed, giant	velvetleaf	field bindweed	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada
Soil Applied Grass Herbicides																																			
EPTAM	x	✓	x	x	x	x	✓	9	9	9	9	9	7	8	–	–	4	2	0	7	7	5	7	7	5	3	5	–	–	–	8	5	–	–
DUAL II MAGNUM	x	x	x	x	✓	x	x	9	9	9	9	9	4	4	0	4	2	2	0	2	7	2	8	8	4	3	2	0	0	0	8	0	0	0
FRONTIER MAX	x	x	x	x	✓	x	x	9	9	9	9	9	4	4	0	4	2	2	0	2	7	2	8	8	4	3	2	0	0	0	8	0	0	0
TREFLAN **or** BONANZA **or** RIVAL	✓	x	x	✓	x	x	✓	9	9	9	9	9	7	8	–	–	5	2	0	2	8	2	2	8	2	2	2	2	2	2	2	2	2	2
Soil Applied Broadleaf Herbicides																																			
AUTHORITY	x	✓	x	x	x	x	✓	–	–	–	–	–	–	–	–	–	9	–	–	–	9	–	9	9	4	–	–	–	–	–	–	–	–	–
CALLISTO	x	✓	x	x	x	✓	x	2	4	0	2	2	2	–	0	0	8	8	8	9	9	9	9	9	7	7	9	2	0	0	0	0	0	0
Postemergence Grass Herbicides																																			
ASSURE II or YUMA GL	✓	✓	✓	x	x	x	x	9	8	9	9	9	9	–	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0
DUAL II MAGNUM	x	x	x	x	x	✓	x	7	7	–	7	–	–	–	0	0	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
EXCEL SUPER	✓	x	x	x	x	x	x	9	8	9	9	9	9	–	8	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0
POAST ULTRA	✓	✓	x	✓	x	x	✓	9	8	9	9	9	9	8	8	7	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0
SELECT or ARROW	✓	✓	x	x	x	x	✓	9	8	9	9	9	9	–	–	–	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0
VENTURE L	✓	x	x	x	✓	x	✓	9	8	9	8	9	8	9	9	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0

[1] Use only on crops planted with certified canola seed designated as "Roundup Ready" canola. See Table 4–3. Glyphosate Products, Registered Uses and Rates Needed, page 72 for a complete list of registered products.

[2] Use only on crops planted with certified canola seed designated as "Liberty Link" canola.

[3] Use only on crops planted with certified canola seed designated as "Pursuit Tolerant" canola products.

[4] Various formulations available, see Table 4–1, Herbicides Used in Ontario, page 30. See label for specific uses and rates.

TABLE 12–1. Canola, Flax, Millet, Mustard, Peanut, Sorghum, Sunflower Herbicide Weed Control Ratings (cont'd)

LEGEND: Numbers (0–9) = weed control ratings – = insufficient information available to make a rating ✓ = can be used on this crop x = not indicated for use on this crop
R = populations resistant to this herbicide exist in Ontario and won't be adequately controlled if present.

	Crop							**Annual Grasses**																				**Perennials**						
Trade Name	**canola**	**flax**	**hemp**	**mustard**	**peanuts**	**sorghum and millet**	**sunflowers**	**barnyard grass**	**crabgrass**	**fall panicum**	**foxtails**	**witchgrass**	**proso millet**	**wild oats**	**vol. corn**	**vol. cereals**	**buckwheat, wild**	**cocklebur**	**fleabane, Canada**	**lady's thumb**	**lamb's-quarters**	**wild mustard**	**nightshades, annual**	**pigweed**	**ragweed, common**	**ragweed, giant**	**velvetleaf**	**field bindweed**	**horsetail**	**milkweed**	**nutsedge**	**quackgrass**	**sow-thistle**	**thistle, Canada**
Postemergence Broadleaf Herbicides																																		
BASAGRAN	x	✓	x	x	x	✓	x	0	0	0	0	0	0	0	0	0	7	9	5	9	7	9	7	7	8	6	9	6	2	2	8	0	6	7
BUCTRIL M **or** BADGE **or** LOGIC M **or** MEXTROL	x	✓	x	x	x	x	x	0	0	0	0	0	0	0	0	0	9	8	6	9	9	9	9	9	9	7	9	7	7	0	0	0	7	7
LONTREL	✓	x	x	x	x	x	x	0	0	0	0	0	0	0	0	0	8	–	9	3	5	0	–	5	8	9	–	3	–	–	0	0	8	8
MCPA	x	✓	x	x	x	x	x	0	0	0	0	0	0	0	0	0	2	7	7	0	9	9	–	9	9	9	7	7	7	0	0	0	7	7
MUSTER	✓	x	x	x	x	x	x	0	0	0	0	0	0	0	–	0	2	0	–	0	2	9	2	8	2	1	0	0	0	0	0	0	0	0
PARDNER **or** BROMOXYNIL[4]	x	x	x	x	x	✓	x	0	0	0	0	0	0	0	0	0	9	7	–	9	9	8	9	8^{R}	9	–	9	7	0	0	0	0	7	7
PEAK + BANVEL II	x	x	x	x	x	✓	x	0	0	0	0	0	0	0	0	0	–	9	6	9	9	9	9	9	9	7	9	–	–	–	–	–	7	7
Postemergence Grass and Broadleaf Herbicides – For Use With Herbicide Tolerant Canola Varieties																																		
glyphosate[1]	✓[1]	x	x	x	x	x	x	9	9	9	9	9	9	9	9	9	8	9	9^{R}	8	9	9	9	9	9	8^{R}	9	7/8	5	8	8	9	8	9
LIBERTY[2]	✓[2]	x	x	x	x	x	x	9	9	9	9	9	9	8	–	–	8	9	7	8	9	9	9	9	9	–	8	6	6	–	6	6	8	7
PURSUIT[3]	✓[3]	x	x	x	x	x	x	8	7	7	9	8	7	8	–	–	8	7	2	9	9	9	9	9	8	6	9	2	2	2	4	5	2	2

[1] Use only on crops planted with certified canola seed designated as "Roundup Ready" canola. See Table 4–3. Glyphosate Products, Registered Uses and Rates Needed, page 72 for a complete list of registered products.

[2] Use only on crops planted with certified canola seed designated as "Liberty Link" canola.

[3] Use only on crops planted with certified canola seed designated as "Pursuit Tolerant" canola products.

[4] Various formulations available, see Table 4–1, Herbicides Used in Ontario, page 30. See label for specific uses and rates.

TABLE 12–1. Canola, Flax, Millet, Mustard, Peanut, Sorghum, Sunflower Herbicide Weed Control Ratings (cont'd)

LEGEND: Numbers (0–9) = weed control ratings – = insufficient information available to make a rating ✓ = can be used on this crop x = not indicated for use on this crop
R = populations resistant to this herbicide exist in Ontario and won't be adequately controlled if present.

	Crop							Annual Grasses																				Perennials						
Trade Name	canola	flax	hemp	mustard	peanuts	sorghum and millet	sunflowers	barnyard grass	crabgrass	fall panicum	foxtails	witchgrass	proso millet	wild oats	vol. corn	vol. cereals	buckwheat, wild	cocklebur	fleabane, Canada	lady's thumb	lamb's-quarters	wild mustard	nightshades, annual	pigweed	ragweed, common	ragweed, giant	velvetleaf	field bindweed	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada
Postemergence Tank-Mixes																																		
POAST ULTRA + (BUCTRIL M **or** BADGE **or** LOGIC M **or** MEXTROL)	x	✓	x	x	x	x	x	9	8	9	9	9	9	8	8	7	9	8	6	9	9	9	9	8	9	7	9	7	7	–	–	6	7	7
POAST ULTRA + LONTREL	✓	x	x	x	x	x	x	9	8	9	9	9	9	8	8	7	8	–	9	3	5	0	–	5	8	9	–	3	–	–	0	6	8	8
POAST ULTRA + MCPA[4]	x	✓	x	x	x	x	x	9	8	9	9	9	9	8	8	7	2	7	7	0	9	9	–	9	9	9	7	7	8	0	0	6	7	7
POAST ULTRA + MUSTER	✓	x	x	x	x	x	x	9	8	9	9	9	9	8	8	7	2	0	–	0	2	9	2	8	2	–	0	0	0	0	0	6	0	0
(SELECT **or** ARROW) + (BUCTRIL M **or** BADGE **or** LOGIC M **or** MEXTROL)	x	✓	x	x	x	x	x	9	8	9	9	9	9	–	–	–	9	8	6	9	9	9	9	8	9	7	9	7	7	–	–	7	7	7
VENTURE + LONTREL	✓	x	x	x	x	x	x	9	8	9	8	9	8	9	9	9	8	–	9	3	5	0	–	5	8	9	–	3	–	–	0	9	8	8
VENTURE + MUSTER	✓	x	x	x	x	x	x	9	8	9	8	9	8	9	9	9	2	0	–	0	2	9	2	8	2	–	0	0	0	0	0	9	0	0

[1] Use only on crops planted with certified canola seed designated as "Roundup Ready" canola. See Table 4–3. Glyphosate Products, Registered Uses and Rates Needed, page 72 for a complete list of registered products.

[2] Use only on crops planted with certified canola seed designated as "Liberty Link" canola.

[3] Use only on crops planted with certified canola seed designated as "Pursuit Tolerant" canola products.

[4] Various formulations available, see Table 4–1, Herbicides Used in Ontario, page 30. See label for specific uses and rates.

Herbicide Treatments include:

- Preplant (PP) – Also see Chapter 6 *Preplant & Postharvest Weed Control*, page 91, for details of products, rates and remarks.

- Preplant Incorporated (PPI) – Two incorporations at right angles operating at a depth of 10 cm using a double disk (7–10 km/h) or vibrating shank S-tine cultivator (10–13 km/h) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Ensure machines are clean and/or treat fields with perennial weeds last.

- Preemergence (PRE) – Rainfall of 15–20 mm within 10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improves herbicide activity in the absence of rainfall.

- Postemergence (POST) – Leaf stage of the weeds is critical for good weed control. Smaller weeds are usually more sensitive to herbicide injury. Apply according to leaf stages specified on the pesticide label. Crop stage is important to optimize crop safety. Adjuvants will frequently improve the weed control when used as directed. Weather or other conditions may influence the optimum rate of adjuvant, see the product label for more details. Always use appropriate drift management technology.

TABLE 12–2. Herbicide Treatment Rates for Field Crops

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
CANOLA – WINTER AND SPRING PLANTED			
Canola – Soil Applied Grass Herbicides			
trifluralin (0.6–1.147 kg/ha)	TREFLAN EC (480 g/L)	1.25–2.4 L/ha (0.5–0.96 L/acre)	• Apply PPI. • Strongly absorbed to soil particles, negligible leaching.
	RIVAL (500 g/L)	1.2–2.3 L/ha (0.4–0.76 L/acre)	
	BONANZA 480 (480 g/L)	1.25–2.4 L/ha (0.5–0.96 L/acre)	
Canola – Postemergence Grass Herbicides			
quizalofop-p-ethyl (0.036–0.072 kg/ha) + oil concentrate (0.5% v/v)	ASSURE II (96 g/L) + SURE-MIX	0.375–0.75 L/ha (0.15–0.3 L/acre) + 5 L/1,000 L	• Apply to annual grasses and volunteer cereals in the 2 leaf to tillering stage and to quackgrass in the 2–6 leaf stage of growth. • Canola is tolerant at all growth stages. • **Do NOT** apply to canola within 64 days of harvest.
	YUMA GL (96 g/L) + XA OIL CONCENTRATE		
fenoxaprop-p-ethyl (0.054 kg/ha)	EXCEL SUPER (80.5 g/L)	0.67 L/ha (0.27 L/acre)	• Apply to annual grasses in the 1–6 leaf stage of growth. • Canola is tolerant at all growth stages. • This treatment will not control volunteer winter wheat.
sethoxydim (0.15–0.2 kg/ha) + surfactant/solvent (1–2 L/ha)	POAST ULTRA (450 g/L) + MERGE	0.32–0.47 L/ha (0.13–0.19 L/acre) + 1–2 L/ha (0.4–0.8 L/acre)	• Apply at 1–6 leaf stages of annual grasses. • Canola is tolerant at all growth stages.
sethoxydim (0.5 kg/ha) + surfactant/solvent (1–2 L/ha)	POAST ULTRA (450 g/L) + MERGE	1.1 L/ha (0.45 L/acre) + 1–2 L/ha (0.4–0.8 L/acre)	• Thorough preplant tillage will provide more uniform quackgrass emergence. • Apply to quackgrass in the 1–3 leaf stage of growth.
clethodim (0.03–0.045 kg/ha) + adjuvant (0.5% v/v)	SELECT (240 g/L) + AMIGO	0.13–0.19 L/ha (0.05–0.08 L/acre) + 5 L/1,000 L	• Canola is tolerant at all growth stages. • Apply to annual grasses and volunteer cereals in the 2–6 leaf stage of growth. • Suppression of quackgrass when applied at the higher dose. • Preharvest Interval (PHI) is 60 days.
	ARROW (240 g/L) + X-ACT ADJUVANT		
fluazifop-p-butyl (0.100 kg/ha)	VENTURE L (125 g/L)	0.8 L/ha (0.32 L/acre)	• For the control of volunteer cereals. • Apply at the 2–5 leaf stage of volunteer cereals.
fluazifop-p-butyl (0.125–0.175 kg/ha)	VENTURE L (125 g/L)	1.0–1.4 L/ha (0.4–0.57 L/acre)	• Apply to annual grasses in the 2–5 leaf stage of growth and 3–5 leaf stage of quackgrass. • Use the 1.4 L/ha (0.57 L/acre) rate for a mixed stand of annual grasses and quackgrass. • **Do NOT** apply VENTURE to canola later than the 5 leaf stage of crop growth.

TABLE 12–2. Herbicide Treatment Rates for Field Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Canola – Postemergence Broadleaf Herbicides			
clopyralid (0.15–0.2 kg/ha)	LONTREL 360 (360 g/L)	0.42–0.56 L/ha (0.17–0.22 L/acre)	· Use **only** on the following cultivars: CYCLONE, EBONY, JEWEL, 46A65 and HYOLA 401. · Apply one postemergence application per season at the 2–6 leaf stage of canola. · Apply to Canada thistle at the rosette to pre-bud stage.
ethametsulfuron-methyl (11 g/ha) + surfactant (0.2% v/v)	MUSTER (75 DF) + AGRAL 90	15 g/ha (6 g/acre) + 2 L/1,000 L	· **Do NOT** apply MUSTER to Polish varieties of canola as crop injury may result. · Apply when the wild mustard in the cotyledon to 6 leaf stages, before the crop begins to bolt. · **Do NOT** apply to winter planted canola. · **Do NOT** plant to any crop except winter wheat in the year of treatment. · **Do NOT** feed or graze treated crop within 60 days of application.
Canola – Postemergence Grass and Broadleaf Herbicides			
sethoxydim (0.15–0.2 kg/ha) + clopyralid (0.15–0.2 kg/ha) + surfactant/solvent (0.75–1 L/ha)	POAST ULTRA (450 g/L) + LONTREL 360 (360 g/L) + MERGE	0.32–0.47 L/ha (0.13–0.19 L/acre) + 0.42–0.56 L/ha (0.17–0.22 L/acre) + 0.75–1 L/ha (0.3–0.4 L/acre)	· Apply when canola is between the 2–6 leaf stages. · LONTREL is used on the following cultivars **only**: CYCLONE, EBONY, JEWEL, 46A65 and HYOLA 401. · Add half the amount of water to tank, add the required amount of POAST ULTRA, and then add the required amount of LONTREL. Add MERGE last along with remaining amount of water to fill the tank.
sethoxydim (0.15–0.2 kg/ha) + ethametsulfuron-methyl (11 g/ha) + surfactant/solvent (0.75–1 L/ha)	POAST ULTRA (450 g/L) + MUSTER (75 DF) + MERGE	0.32–0.47 L/ha (0.13–0.19 L/acre) + 15 g/ha (6 g/acre) + 0.75–1 L/ha (0.3–0.4 L/acre)	· **Do NOT** apply to winter planted canola. · Apply when canola is between the 2 leaf stage and bolting. · Add MUSTER to the tank first and agitate. Once MUSTER is in suspension add the required amount of POAST ULTRA, followed by the correct amount of MERGE.
sethoxydim (0.15–0.2 kg/ha) + ethametsulfuron-methyl (11 g/ha) + clopyralid (0.15 kg/ha) + surfactant/solvent (0.75–1 L/ha)	POAST ULTRA (450 g/L) + MUSTER (75 DF) + LONTREL 360 (360 g/L) + MERGE	0.32–0.47 L/ha (0.13–0.19 L/acre) + 15 g/ha (6 g/acre) + 0.42 L/ha (0.17 L/acre) + 0.75–1 L/ha (0.3–0.4 L/acre)	· **Do NOT** apply to winter planted canola. · Apply when canola is between the 2 leaf stage and bolting. · Add MUSTER to the tank first and agitate. Once MUSTER is in suspension add the required amount of POAST ULTRA, followed by the correct amount of MERGE.
fluazifop-p-butyl 0.125–0.175 kg/ha + clopyralid (0.15–0.2 kg/ha)	VENTURE L (125 g/L) + LONTREL 360 (360 g/L)	1.0–1.4 L/ha (0.4–0.57 L/acre) + 0.42–0.56 L/ha (0.17–0.22 L/acre)	· **Do NOT** apply VENTURE to canola later than the 5 leaf stage of crop growth. · LONTREL is to be used **ONLY** on the following cultivars: CYCLONE, EBONY, JEWEL, 46A65 and HYOLA 401. · Add VENTURE to the tank first and agitate before adding LONTREL L.
fluazifop-p-butyl (0.125–0.175 kg/ha) + ethametsulfuron-methyl (11 g/ha)	VENTURE L (125 g/L) + MUSTER (75 DF)	1.0–1.4 L/ha (0.4–0.57 L/acre) + 15 g/ha (6 g/acre)	· **Do NOT** apply to winter planted canola. · **Do NOT** apply VENTURE to canola later than the 5 leaf stage of crop growth. · **Do NOT** apply MUSTER tank-mix to Polish varieties of canola as crop injury may result. · Add MUSTER to the tank-mix first and agitate before adding VENTURE.

TABLE 12–2. Herbicide Treatment Rates for Field Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Canola – Postemergence Grass and Broadleaf Herbicides (for use with herbicide tolerant varieties only)			
glyphosate (0.297–0.45 kg/ha)	glyphosate (360 g/L)*	0.825–1.25 L/ha (0.33–0.5 L/acre)	· For use only with pedigreed (certified) canola seed designated as "Roundup Ready" canola. · Apply up to the 6 leaf stage of the canola. A second application may be made for later flushes emerging after the initial application and for improved results on perennial weeds. · The higher rate should be used when weeds are larger, when weed pressure is high and for perennial weeds. * See Table 4–1. Herbicides Used in Ontario, page 30, for formulations available. See label for specific uses and rates.
	glyphosate (450 g/L)*	0.66–1 L/ha (0.26–0.4 L/acre)	
	glyphosate (480 g/L)*	0.62–0.94 L/ha (0.25–0.38 L/acre)	
	glyphosate (500 g/L)*	0.6–0.9 L/ha (0.24–0.36 L/acre)	
	glyphosate (540 g/L)*	0.55–0.83 L/ha (0.22–0.33 L/acre)	
glufosinate ammonium (0.50 kg/ha)	LIBERTY 200 SN (200 g/L)	2.5 L/ha (1 L/acre)	· LIBERTY 200 SN can be applied from the cotyledon to the early bolting stage of canola. · For use only with canola seed designated as "Liberty Link" canola. · Ammonium sulphate can be applied at 6 L/ha (2.4 L/acre) (liquid) or 3.3 kg/ha (1.3 kg/acre) (dry) for improved control of specific weeds. · **Do NOT** add oil or any other surfactants.
imazethapyr (0.075 kg/ha) + non ionic surfactant (0.25% v/v) + liquid fertilizer (2 L/ha)	PURSUIT (240 g/L) + non-ionic surfactant + liquid fertilizer 10-34-0, 28-0-0 or 32-0-0	0.312 L/ha (0.125 L/acre) + 2.5 L/1,000 L + 2 L/ha (0.8 L/acre)	· For use on imazethapyr tolerant canola only. · Apply early postemergence when the crop has at least one fully expanded leaf and before the weeds reach the 2 true leaf stage. · PURSUIT will provide residual weed control from soil activity. · Some rotational cropping restrictions apply, see Table 4–4. Herbicide Crop Rotation and Soil pH Restrictions: Field Crops, page 74.
glyphosate (0.45 kg/ha) + clopyralid (0.10 kg/ha)	glyphosate (360 g/L)* + LONTREL 360 (360 g/L)	1.25 L/ha (0.5 L/acre) + 0.28 L/ha (0.11 L/acre)	· For use only with certified canola seed designated as "Roundup Ready" canola. · Provides season long top growth control of Canada thistle and control of wild buckwheat. · Apply when canola is in the 2–6 leaf stage. · Apply in 100 L/ha (40 L/acre) of water. · For more information on weed controlled and rates, refer to the LONTREL and appropriate glyphosate product labels. * See Table 4–1. Herbicides Used in Ontario, page 30, for formulations available. See label for specific uses and rates.
	glyphosate (450 g/L)* + LONTREL 360 (360 g/L)	1 L/ha (0.4 L/acre) + 0.28 L/ha (0.11 L/acre)	
	glyphosate (480 g/L)* + LONTREL 360 (360 g/L)	0.94 L/ha (0.38 L/acre) + 0.28 L/ha (0.11 L/acre)	
	glyphosate (500 g/L)* + LONTREL 360 (360 g/L)	0.9 L/ha (0.36 L/acre) + 0.28 L/ha (0.11 L/acre)	
	glyphosate (540 g/L)* + LONTREL 360 (360 g/L)	0.83 L/ha (0.33 L/acre) + 0.28 L/ha (0.11 L/acre)	

TABLE 12–2. Herbicide Treatment Rates for Field Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Canola – Preharvest			
glyphosate (0.9 kg/ha)	glyphosate (360 g/L)*	2.5 L/ha (1 L/acre)	· Apply in 50–100 L/ha (20–40 L/acre) water when the crop is less than 30% grain moisture, when pods are green to yellow and seeds are yellow to brown and 7–14 days prior to harvest and use ground application only. · **Do NOT** apply to seed crops. * See Table 4–1. Herbicides Used in Ontario, page 30, for formulations available. See label for specific uses and rates.
	glyphosate (450 g/L)*	2 L/ha (0.8 L/acre)	
	glyphosate (480 g/L)*	1.875 L/ha (0.75 L/acre)	
	glyphosate (500 g/L)*	1.8 L/ha (0.72 L/acre)	
	glyphosate (540 g/L)*	1.67 L/ha (0.67 L/acre)	
Canola – Harvest-Aid			
diquat (0.3–0.408 kg/ha) + surfactant (0.1% v/v)	REGLONE DESICCANT (240 g/L) + AGRAL 90	1.25–1.7 L/ha (0.5–0.68 L/acre) + 1 L/1,000 L	· Apply when crop is 80%–90% seed turn (green to brown) stage. · Harvest no later than 14 days after herbicide application to avoid pod shatter. · Use higher rate for heavy canopy. · Use minimum of 225 L/ha spray volume. · **Drift** will injure adjacent crops or plants.
saflufenacil (25.2–49.7 g/ha) + adjuvant	ERAGON LQ (342 g/L) + MERGE	73–146 mL/ha (29.5–59 mL/acre) + 1 L/ha (0.4 L/acre)	· Apply when 60–75% of seeds have changed colour · Apply in 200 L/ha (80 L/acre) of water. · Preharvest interval (PHI) is 3 days.
saflufenacil (25.2–49.7 g/ha) + glyphosate (900 g/ha) + adjuvant	ERAGON LQ (342 g/L) + glyphosate (360 g/L) MERGE	73–146 mL/ha (29.5–59 mL/acre) + 2.5 L/ha (1 L/acre) + 1 L/ha (0.4 L/acre)	· Apply when 60–75% of seeds have changed colour · Apply in 200 L/ha (80 L/acre) of water. · **Do NOT** apply to crops grown for seed. · Preharvest interval (PHI) is 3 days.

TABLE 12–2. Herbicide Treatment Rates for Field Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
FLAX			
Preplant (PP) – See Chapter 6 *Preplant & Postharvest Weed Control*, page 91, for details of products, rates and remarks.			
Flax – Soil Applied Broadleaf Herbicides			
sulfentrazone (105–140 g/ha)	AUTHORITY (480 g/L)	219–292 mL/ha (88–117 mL/acre)	· Apply PP or PRE but no later than 3 days after planting. · Some rotational cropping restrictions apply (see Table 4–4. Herbicide Crop Rotation and Soil pH Restrictions: Field Crops, page 74). · **Do NOT** apply to flax grown on coarse-textured (sandy) soils. · **Do NOT** apply to soils with organic matter greater than 6%. · **Do NOT** apply to soils with a pH greater than 7.8. · The highest use rate should be used when applied to soils with a pH of less than 7 and with organic matter greater than 3% but less than 6%.
mesotrione (140 g/ha)	CALLISTO (480 g/L)	0.3 L/ha (0.12 L/acre)	· Apply PRE. · If flax is emerged at time of application, severe injury will occur. · **Do NOT** graze treated immature crops or cut for forage or hay.
Flax – Postemergence Grass Herbicides			
quizalofop-p-ethyl (0.036–0.072 kg/ha) + oil concentrate (0.5% v/v)	ASSURE II (96 g/L) + SURE-MIX YUMA GL (96 g/L) + XA OIL CONCENTRATE	0.375–0.75 L/ha (0.15–0.3 L/acre) + 5 L/1,000 L	· Apply to emerged annual grasses and volunteer cereals in the 2 leaf to tillering stage and to quackgrass in the 2–6 leaf stage of growth. · Use the 0.375 L/ha (0.15 L/acre) rate for control of volunteer corn, volunteer cereals and green foxtail. · The 0.5 L/ha (0.2 L/acre) rate provides suppression of quackgrass and will also control barnyard grass. · Use the 0.75 L/ha (0.3 L/acre) rate for control of quackgrass. · **Do NOT** apply to flax within 82 days of harvest.
sethoxydim (0.15–0.2 kg/ha) + oil concentrate (2 L/ha) or surfactant/solvent (1 L/ha)	POAST ULTRA (450 g/L) + ASSIST POAST ULTRA (450 g/L) + MERGE	0.32–0.47 L/ha (0.13–0.19 L/acre) + 2 L/ha (0.8 L/acre) 0.32–0.47 L/ha (0.13–0.19 L/acre) + 1 L/ha (0.4 L/acre)	· **Do NOT** use on low-linolenic varieties. · Treat the 1–6 leaf stage of annual grass. · For annual grasses and volunteer cereals. · Use the higher rate when volunteer cereals are present. · Use MERGE for conditions or weeds requiring medium to high rates of POAST ULTRA. · Flax is tolerant at any stage of growth. · Apply using 110–200 L/ha of water (44–80 L/acre).
sethoxydim (0.5 kg/ha) + surfactant/solvent (1–2 L/ha)	POAST ULTRA (450 g/L) + MERGE	1.1 L/ha (0.45 L/acre) + 1–2 L/ha (0.4–0.8 L/acre)	· **Do NOT** use on low-linolenic varieties. · For quackgrass control. Thorough preplant tillage will ensure more uniform quackgrass emergence. · Apply using 100–200 L/ha of water (40–80 L/acre).
clethodim (0.03–0.09 kg/ha) + surfactant (0.5–1% v/v)	SELECT (240 g/L) + AMIGO ARROW (240 g/L) + X-ACT ADJUVANT	0.13–0.38 L/ha (0.05–0.15 L/acre) + 5–10 L/1,000 L	· Apply when the annual grasses and volunteer cereals are in the 2–6 leaf stages. · Apply to quackgrass in the 2–5 leaf stages. Use the higher rate for control of quackgrass. · Flax is tolerant at any growth stage. · Preharvest Interval (PHI) is 60 days.
fluazifop-p-butyl (0.075 kg/ha)	VENTURE L (125 g/L)	0.6 L/ha (0.24 L/acre)	· Apply at 2–4 leaf stage of annual grasses.
fluazifop-p-butyl (0.25 kg/ha)	VENTURE L (125 g/L)	2 L/ha 0.8 L/acre	· Apply at 3–5 leaf stage of quackgrass.

TABLE 12–2. Herbicide Treatment Rates for Field Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Flax – Postemergence Broadleaf Herbicides			
bentazon (0.84–1.08 kg/ha) + oil concentrate (2 L/ha)	BASAGRAN (480 g/L) + ASSIST	1.75–2.25 L/ha (0.7–0.9 L/acre) + 2 L/ha (0.8 L/acre)	· Apply when flax is 5 cm or higher and weeds are small and actively growing. · Top growth of nutsedge and Canada thistle is controlled and field bindweed may be suppressed. Two applications of 1.75 L/ha (0.7 L/acre) (0.84 kg active/ha), 10 days apart may be required. · A new flush of weeds may emerge after the first flush has been controlled. · Cool weather or drought may reduce control. · Reduce oil concentrate to 1 L/ha (0.4 L/acre) under abnormally hot and humid weather conditions or temporary crop injury may occur.
bromoxynil/mcpa (0.56 kg/ha)	BUCTRIL M ((1:1) 560 g/L)	1 L/ha (0.4 L/acre)	· Apply when the flax is 5–10 cm high before weeds have developed beyond the 4 leaf stage. · **Do NOT** use if the daytime temperature is over 29°C.
	BADGE ((1:1) 450 g/L)	1.25 L/ha (0.5 L/acre)	
	LOGIC M ((1:1) 450 g/L)		
	MEXTROL ((1:1) 450 g/L)		
MCPA (0.5 kg/ha)	MCPA AMINE (500 g/L)*	1 L/ha (0.4 L/acre)	· Flax may be treated when 5 cm tall to bud stage. · Best weed control is obtained if the application is made when the weeds are small (approx. 5 cm tall). * See Table 4–1. Herbicides Used in Ontario, page 30, for formulations available. See label for specific uses and rates.
Flax – Postemergence Grass and Broadleaf Herbicides			
sethoxydim (0.15–0.2 kg/ha) + bromoxynil/ mcpa (0.56 kg/ha) + surfactant/solvent (1 L/ha)	POAST ULTRA (450 g/L) + BUCTRIL M ((1:1) 560 g/L) + MERGE	0.32–0.47 L/ha (0.13–0.19 L/acre) + 1 L/ha (0.4 L/acre) + 1 L/ha (0.4 L/acre)	· Apply when flax is 5–10 cm high before weeds have developed beyond the 4 leaf stage. · **Do NOT** use if the daytime temperature is over 29°C. · Apply using 100–200 L/ha of water (40–80 L/acre).
	POAST ULTRA (450 g/L) + BADGE ((1:1) 450 g/L) + MERGE	0.32–0.47 L/ha (0.13–0.19 L/acre) + 1.25 L/ha (0.5 L/acre) + 1 L/ha (0.4 L/acre)	
	POAST ULTRA (450 g/L) + LOGIC M ((1:1) 450 g/L) + MERGE		
	POAST ULTRA (450 g/L) + MEXTROL ((1:1) 450 g/L) + MERGE		
sethoxydim (0.15–0.2 kg/ha) + MCPA (0.42–0.55 kg/ha) + surfactant/solvent (1 L/ha)	POAST ULTRA (450 g/L) + MCPA AMINE (500 g/L)* + MERGE	0.32–0.47 L/ha (0.13–0.19 L/acre) + 0.84–1.1 L/ha (0.34–0.44 L/acre) + 1 L/ha (0.4 L/acre)	· Flax may be treated when 5 cm tall to bud stage. · Best weed control is obtained if the application is made when the weeds are small (approximately 5 cm tall). · Apply using 100–200 L/ha of water (40–80 L/acre). * See Table 4–1. Herbicides Used in Ontario, page 30, for formulations available. See label for specific uses and rates.

TABLE 12–2. Herbicide Treatment Rates for Field Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Flax – Postemergence Grass and Broadleaf Herbicides (cont'd)			
clethodim (0.045 kg/ha) + bromoxynil/mcpa (0.56 kg/ha) + surfactant (0.5% v/v)	SELECT (240 g/L) + BUCTRIL M ((1:1) 560 g/L) + AMIGO	0.19 L/ha (0.076 L/acre) + 1 L/ha (0.4 L/acre) + 5 L/1,000 L	· Apply when flax is 5–10 cm high and weeds are in the seedling stage for best results. · **Do NOT** use if daytime temperature is over 25°C.
	SELECT (240 g/L) + BADGE ((1:1) 450 g/L) + AMIGO	0.19 L/ha (0.076 L/acre) + 1.25 L/ha (0.5 L/acre) + 5 L/1,000 L	
	SELECT (240 g/L) + LOGIC M ((1:1) 450 g/L) + AMIGO		
	SELECT (240 g/L) + MEXTROL ((1:1) 450 g/L) + AMIGO		
Flax – Preharvest			
glyphosate (0.9 kg/ha)	glyphosate (360 g/L)*	2.5 L/ha (1 L/acre)	· Apply in 50–100 L/ha (20–40 L/acre) water when the crop is less than 30% grain moisture, when the majority of bolls are brown (75%–80%) and 7–14 days prior to harvest. · **Do NOT** apply to seed crops. * See Table 4–1. Herbicides Used in Ontario, page 30, for formulations available. See label for specific uses and rates.
	glyphosate (450 g/L)*	2 L/acre (0.8 L/acre)	
	glyphosate (480 g/L)*	1.875 L/ha (0.75 L/acre)	
	glyphosate (500 g/L)*	1.8 L/ha (0.72 L/acre)	
	glyphosate (540 g/L)*	1.67 L/ha (0.67 L/acre)	
diquat (0.3–0.408 kg/ha) + non-ionic surfactant (0.1% v/v)	REGLONE DESICCANT (240 g/L) + AGRAL 90	1.25–1.7 L/ha (0.5–0.68 L/acre) + 1 L/1,000 L	· Apply when the crop is at 75% boll turn stage. · **Do NOT** apply to immature crop. · This application reduces dry down time and eliminates the need for swathing.

INDUSTRIAL HEMP GROWN FOR FIBRE PRODUCTION

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS
Site Preparation Before Planting – See Chapter 6 Preplant & Postharvest Weed Control, page 91.			
Industrial Hemp – Postemergence Grass Herbicides			
quizalofop-p-ethyl (0.036–0.07 kg/ha) + oil concentrate (0.5% v/v)	ASSURE II (96 g/L) + SURE-MIX	0.38–0.75 L/ha (0.15–0.3 L/acre) + 5 L/1,000 L	· Make one application per year. Apply to emerged annual grasses and volunteer cereals when the crop is at the 2–6 crop leaf stage (6–25 cm in height). · Use the 0.38 L/ha (0.15 L/acre) rate of ASSURE II for control of volunteer corn, volunteer cereals and green foxtail. · The 0.5 L/ha (0.2 L/acre) rate of ASSURE II will suppress quackgrass and also control barnyard grass. · Use the 0.75 L/ha (0.3 L/acre) rate of ASSURE II for control of quackgrass. · Use a minimum of 100 litres of water/ha with a spray pressure of 210–275 kPa.
	YUMA GL (96 g/L) + XA OIL CONCENTRATE		

TABLE 12–2. Herbicide Treatment Rates for Field Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
MUSTARD			
Preplant (PP) – See See Chapter 6 Preplant & Postharvest Weed Control, page 91, for details of products, rates and remarks.			
Mustard – Soil Applied Grass and Broadleaf Herbicides			
trifluralin (0.6–1.147 kg/ha)	TREFLAN EC (480 g/L)	1.25–2.4 L/ha (0.5–0.96 L/acre)	· Apply PPI. · Strongly absorbed to soil particles, negligible leaching. · **Do NOT** use on sandy soils. · Can be applied immediately prior to, or up to 3 weeks before planting.
	RIVAL (500 g/L)	1.2–2.3 L/ha (0.4–0.76 L/acre)	
	BONANZA 400 (400 g/L)	1.5–2.75 L/ha (0.6–1.1 L/acre)	
Mustard – Postemergence Grass Herbicides			
clethodim (0.03–0.09 kg/ha) + surfactant (0.5–1% v/v)	SELECT (240 g/L) + AMIGO	0.13–0.38 L/ha (0.05–0.15 L/acre) + 5–10 L/1,000 L	· Apply when the annual grasses and volunteer cereals are in the 2–6 leaf stages. · Apply to quackgrass in the 2–5 leaf stages. Use the higher rate for control of quackgrass. · Preharvest Interval (PHI) is 60 days.
	ARROW (240 g/L) + X-ACT ADJUVANT		
sethoxydim (0.15–0.2 kg/ha) + oil concentrate (2 L/ha)	POAST ULTRA (450 g/L) + ASSIST	0.32–0.47 L/ha (0.13–0.19 L/acre) + 2 L/ha (0.8 L/acre)	· Treat the 1–6 leaf stage of annual grass. · For annual grasses and volunteer cereals. · Use the higher rate when volunteer cereals are present. · Use MERGE for conditions or weeds requiring medium to high rates of POAST ULTRA. · Apply using 110–200 L/ha of water (44–80 L/acre).
sethoxydim (0.15–0.2 kg/ha) + surfactant/solvent (1 L/ha)	POAST ULTRA (450 g/L) + MERGE	0.32–0.47 L/ha (0.13–0.19 L/acre) + 1 L/ha (0.4 L/acre)	
sethoxydim (0.5 kg/ha) + surfactant/solvent	POAST ULTRA (450 g/L) + MERGE	1.1 L/ha (0.45 L/acre) + 1–2 L/ha (0.4–0.8 L/acre)	· For quackgrass control. Thorough preplant tillage will ensure more uniform quackgrass emergence. · Apply using 100–200 L/ha of water (40–80 L/acre).
Mustard – Preharvest			
diquat (0.3–0.408 kg/ha) + surfactant (0.1% v/v)	REGLONE DESICCANT (240 g/L) + AGRAL 90	1.25–1.7 L/ha (0.5–0.68 L/acre) + 1 L/1,000 L	· Apply when crop is 60%–75% seed turn (green to brown) stage. · Harvest no later than 14 days after herbicide application to avoid pod shatter. · Use higher rate for heavy canopy. · Use minimum of 225 L/ha spray volume. · Drift will injure adjacent crops or plants.

TABLE 12–2. Herbicide Treatment Rates for Field Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
PEANUTS			
Preplant (PP) – See See Chapter 6 Preplant & Postharvest Weed Control, page 91, for details of products, rates and remarks.			
Peanuts – Preemergence Grass Herbicides			
dimethenamid (544–619 g/ha)	FRONTIER MAX (720 g/L)	756–860 mL/ha (302–344 mL/acre)	• Apply PPI. • Peanuts should be seeded at least 4 cm deep or crop injury may occur. • **Do NOT** apply within 80 days of harvest.
s-metolachlor/benoxacor (1,050–1,418 g/ha)	DUAL II MAGNUM (915 g/L)	1.15–1.55 L/ha (0.46–0.62 L/acre)	• Use the higher rate of DUAL II MAGNUM for heavier weed infestations. • For optimum yellow nutsedge control, apply DUAL II MAGNUM as a pre-plant incorporated application. • **Do NOT** graze of feed peanut forage or fodder to livestock for 30 days following application. • **Do NOT** harvest crop within 90 days of application. • Application of DUAL II MAGNUM may result in injury to the peanut crop which may include stand loss, delayed maturity and loss of yield.
Peanuts – Postemergence Broadleaf Herbicides			
bentazon (1.08 kg/ha) + oil concentrate (2 L/ha)	BASAGRAN (480 g/L) + ASSIST	2.25 L/ha (0.9 L/acre) + 2 L/ha (0.8 L/acre)	• Apply when peanuts are in the unifoliate to 4th trifoliate leaf stage and when weeds are small and actively growing. • Many annual broadleaf weeds including velvetleaf (15 cm/up to 6 leaf), smartweed (20 cm/up to 10 leaf) and cocklebur (30 cm/up to 10 leaf) are controlled. • Top growth of Canada thistle and yellow nutsedge is controlled and field bindweed may be suppressed but 2 applications of BASAGRAN at 1.75 L/ha (0.7 L/acre) 10 days apart may be required. • A new flush of weeds may emerge after the first flush has been controlled. • Temporary crop injury may occur under abnormally cool or hot, humid conditions. Reduce rate of oil concentrate to 1 L/ha (0.4 L/acre) when those conditions occur. Cool weather or drought may delay or reduce control.
Peanuts – Postemergence Grass Herbicides			
fluazifop-p-butyl (0.100 kg/ha)	VENTURE L (125 g/L)	0.8 L/ha (0.32 L/acre)	• For the control of volunteer cereals. • Apply at the 2–5 leaf stage of volunteer cereals. • Pre Harvest Interval – 40 days • ONLY one application per season
fluazifop-p-butyl (0.125–0.175 kg/ha)	VENTURE L (125 g/L)	1.0–1.4 L/ha (0.4–0.57 L/acre)	• Apply to annual grasses in the 2–5 leaf stage of growth and 3–5 leaf stage • of quackgrass. • Use the 1.4 L/ha (0.57 L/acre) rate for a mixed stand of annual grasses and quackgrass. • Pre Harvest Interval – 40 days • ONLY one application per season

TABLE 12–2. Herbicide Treatment Rates for Field Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
SORGHUM AND MILLET (GRAIN)			
Preplant (PP) – See See See Chapter 6 Preplant & Postharvest Weed Control, page 91, for details of products, rates and remarks.			
Sorghum and Millet (Grain) – Soil Applied Broadleaf Herbicides			
mesotrione (140 g/ha)	CALLISTO (480 g/L)	0.3 L/ha (0.12 L/acre)	• Apply 7–14 days prior to sorghum and pearl millet planting. • Application to emerged sorghum or pearl millet can result in severe crop injury. • Apply up to the 2-leaf stage of weeds. • **Do NOT** apply to pearl millet or sorghum grown in coarse textured soils or to sudangrass, or sorghum-sudangrass hybrids.
Sorghum and Millet (Grain) – Postemergence Broadleaf Herbicides			
bentazon (0.84–1.08 kg/ha)	BASAGRAN FORTÉ (480 g/L)	1.75–2.25 L/ha (0.7–0.9 L/acre)	• Apply when the crop is at the 3–6 leaf stage. • Annual weeds should be targeted at the 4–6 leaf stage. • A new flush of weeds may emerge after the first flush has been controlled. • Cool weather or drought may reduce control. • Reduce oil concentrate to 1 L/ha (0.4 L/acre) under abnormally hot and humid weather conditions or temporary crop injury may occur. • **Do NOT** apply within 100 days of harvest.
bromoxynil (0.28 kg/ha)	PARDNER (280 g/L)	1 L/ha (0.4 L/acre)	• Apply when the crop is at or beyond the 4 leaf stage and less than 20 cm in height. • One application per year. • **Do NOT** apply within 100 days of harvest.
	BROMOXYNIL (240 g/L)*	1.2 L/ha (0.48 L/acre)	
	BROMOXYNIL (480 g/L)*	0.6 L/ha (0.24 L/acre)	
prosulfuron + dicamba (10 g/ha + 0.14 kg/ha) + non-ionic surfactant (0.2% v/v)	PEAK (75 WG) + BANVEL II (480 g/L) + AGRAL 90	13.3 g/ha (5.3 g/acre) + 0.3 L/ha (0.12 L/acre) + 2 L/1,000 L	• Apply when the crop is between 3–5 leaf stage. • Best results when applied to actively growing weeds in the 1–6 leaf stage. • **Do NOT** apply by air. • Make **ONLY** one application per year.
Sorghum and Millet (Grain) – Postemergence Grass Herbicides			
s-metolachlor/benoxacor (572 g/ha)	DUAL II MAGNUM (915 g/L)	625 mL/ha (253 mL/acre)	• Apply after crop emergence but before weed emergence (typically the 1–3 leaf stage of sorghum). A stale seedbed will minimize the amount of weeds emerged at time of application. • For use in pearl millet that is intended for **ANIMAL FEED ONLY**. **Do NOT** apply to grain millet that is intended for **HUMAN CONSUMPTION**. • **Do NOT** harvest pearl millet for forage within 45 days of application. • **Do NOT** harvest pearl millet for grain within 130 days of application. • Application of DUAL II MAGNUM will result in injury to the pearl millet crop which may include stand loss, delayed maturity and loss of yield. • Millet should be seeded at least 2.5 cm deep or crop injury may result.

TABLE 12–2. Herbicide Treatment Rates for Field Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
SUNFLOWERS			
• Cultural control of weeds in sunflowers can be used successfully, but only if weeds are also controlled in other crops in the rotation. There are several tillage options in the sunflower crop. • Preplant tillage can control 1 or 2 flushes of early germinating weeds. Plant sunflowers immediately after the last tillage operation. • A rotary hoe set to cultivate shallow can be effective in removing annual weeds that are just emerging. It is not very useful for controlling well-rooted seedlings. • Spring tooth harrows can be used to control small weeds when sunflowers are in the 4–6 leaf stages. There will be some damage to sunflowers and larger weeds will not be well controlled. • One or 2 cultivations with a row crop cultivator are the most common form of cultural control. Sunflowers have to be big enough to withstand burial. Lateral roots on sunflowers are shallow, so avoid cultivating too deep or too close to plants.			
Sunflowers – Soil Applied Grass Herbicides			
EPTC (3.4 kg/ha)	EPTAM (800 g/L)	4.25 L/ha (1.7 L/acre)	• Apply PPI. • **Do NOT** use on light sandy soils with less than 3% organic matter.
trifluralin (0.6–1.155 kg/ha)	TREFLAN EC (480 g/L)	1.25–2.4 L/ha (0.5–0.96 L/acre)	• Apply PPI.
	RIVAL (500 g/L)	1.2–2.3 L/ha (0.48–0.92 L/acre)	
Sunflower – Soil Applied Broadleaf Herbicides			
sulfentrazone (105–140 g/ha)	AUTHORITY (480 g/L)	219–292 mL/ha (88–117 mL/acre)	• Apply PP or PRE but no later than 3 days after planting. • Some rotational cropping restrictions apply (see Table 4–4. Herbicide Crop Rotation and Soil pH Restrictions: Field Crops, page 74). • **Do NOT** apply to flax grown on coarse-textured (sandy) soils. • **Do NOT** apply to soils with organic matter greater than 6%. • **Do NOT** apply to soils with a pH greater than 7.8. • The highest use rate should be used when applied to soils with a pH of less than 7 and with organic matter greater than 3% but less than 6%.
Sunflowers – Postemergence Grass Herbicides			
sethoxydim (0.15–0.2 kg/ha) + oil concentrate (2 L/ha)	POAST ULTRA (450 g/L) + ASSIST	0.32–0.47 L/ha (0.13–0.19 L/acre) + 2 L/ha (0.8 L/acre)	• Treat the 1–6 leaf stage of annual grass. • For annual grasses and volunteer cereals. • Use the higher rate when volunteer cereals are present. • Use MERGE for conditions or weeds requiring medium to high rates of POAST ULTRA. • Apply using 110–200 L/ha of water (44–80 L/acre).
sethoxydim (0.15–0.2 kg/ha) + surfactant/solvent (1 L/ha)	POAST ULTRA (450 g/L) + MERGE	0.32–0.47 L/ha (0.13–0.19 L/acre) + 1 L/ha (0.4 L/acre)	
sethoxydim (0.5 kg/ha) + surfactant/solvent	POAST ULTRA (450 g/L) + MERGE	1.1 L/ha (0.45 L/acre) + 1–2 L/ha (0.4–0.8 L/acre)	• For quackgrass control. Thorough preplant tillage will ensure more uniform quackgrass emergence. • Apply using 100–200 L/ha of water (40–80 L/acre).
clethodim (0.03–0.09 kg/ha) + surfactant (0.5–1% v/v)	SELECT (240 g/L) + AMIGO	0.13–0.38 L/ha (0.05–0.15 L/acre) + 5–10 L/1,000 L	• Apply when the annual grasses and volunteer cereals are in the 2–6 leaf stages. • Apply to quackgrass in the 2–5 leaf stages. Use the higher rate for control of quackgrass. • Allow 72 days between application and harvest.
	ARROW (240 g/L) + X-ACT ADJUVANT		
fluazifop-p-butyl (0.075 kg/ha)	VENTURE L (125 g/L)	0.6 kg/ha (0.24 L/acre)	• This rate is for control of volunteer corn only. • Apply at 2–5 leaf stage of the volunteer corn.
fluazifop-p-butyl (0.125–0.18 kg/ha)	VENTURE L (125 g/L)	1.0–1.4 L/ha (0.4–0.57 L/acre)	• Apply at 2–4 leaf stage of annual grasses and at 3–5 leaf stage quackgrass.

TABLE 12–2. Herbicide Treatment Rates for Field Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Sunflowers – Harvest-Aid			
diquat (0.3 kg/ha) + surfactant (0.1% v/v)	REGLONE DESICCANT (240 g/L) + AGRAL 90	1.25 L/ha (0.5 L/acre) + 1 L/1,000 L	· REGLONE may be used to reduce the period of time from maturity to harvest, to speed up harvesting, and decrease seed moisture at harvest. · Spray when seeds reach maturity (20–50% seed moisture). · Combine 15–20 days after spraying. · Beware of drift to adjacent crops or plants. · See Chapter 4, Herbicides Used in Ontario, page 27, for comments on aerial application.
TOBACCO			
Tobacco – Post Transplant Herbicides			
Apply in 150–300 L/ha (60–120 L/acre) water.			
napropamide (1.125–2.25 kg/ha)	DEVRINOL DF (50 DF) DEVRINOL DF-XT (50 DF-XT)	2.25–4.5 kg/ha (0.9–1.8 kg/acre)	· Apply immediately following transplanting in a 25–30 cm band over the transplants. · Use lower rates on lighter soils. · For best results, lightly incorporate or apply irrigation if rainfall does not occur within 2 days of application. · After harvest, soil should be worked at right angles to the rows to prevent injury to succeeding crops. Small grains may be seeded in the fall to prevent soil erosion. These grains may be stunted but not otherwise affected.
fluazifop-p-butyl (0.075–0.125 kg/ha)	VENTURE L (125 g/L)	0.6–1 L/ha (0.24–0.4 L/acre)	· May be applied up to 45 days to harvest.

13. VEGETABLE CROPS

NOTES: Weed control ratings are given as 0–9 where 0 indicates no control and 9 indicates 90%–100% control under ideal conditions. Ratings are subjective values based on best available information and give general comparisons based on use as described in this guide. Under unfavourable conditions (e.g., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated. Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used. Please refer to product label for more information on registered weed species, product uses and precautions.

TABLE 13–1. Vegetable Herbicide Weed Control Ratings

LEGEND: Numbers (0–9) = weed control ratings – = insufficient information available to make a rating

	Grasses					Annual Broadleaves								Perennials						
Trade Name	barnyard grass	crabgrass	fall panicum	foxtails	witchgrass	buckwheat, wild	lady's-thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada
Soil Applied Grass Herbicides																				
DEVRINOL	8	9	8	8	8	5	6	8	5	5	8	7	5	5	5	5	6	5	5	5
EPTAM	9	9	9	9	9	4	7	7	5	7	7	5	5	–	–	–	8	5	–	–
FRONTIER MAX	9	9	8	9	9	2	2	7	2	8	8	4	2	0	0	0	8	0	0	0
Prefar	9	9	–	9	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Soil Applied Broadleaf Herbicides																				
GESAGARD	–	–	–	9	–	–	8	9	8	8	8	6	–	–	–	–	–	–	–	–
LOROX DF or L	7	5	5	7	7	8	9	9	9	8	9	8	6	2	2	2	2	2	2	2
PYRAMIN	5	5	5	5	5	8	8	8	8	8	8	8	6	5	5	–	5	5	5	5
REFLEX	0	0	0	0	0	7	8	6	8	3	9	9	6	3	6	2	–	0	5	3
SANDEA	0	0	0	0	0	–	8	8	8	–	8	8[6]	8	6	0	0	6	–	–	–

[1] Good control of these perennial weeds may require two applications, 7–10 days part.
[2] Yellow foxtail will only be suppressed.
[3] Registered for control of hairy nightshade.
[4] Repeated applications may be necessary if regrowth occurs.
[5] Weeds cannot be emerged at time of application to achieve this level of control.
[6] Registered for preemergent activity on common ragweed only
[7] Various formulations available, see Table 4–1. Herbicides Used in Ontario, page 30.

TABLE 13–1. Vegetable Herbicide Weed Control Ratings (cont'd)

LEGEND: Numbers (0–9) = weed control ratings – = insufficient information available to make a rating

Trade Name	Grasses					Annual Broadleaves								Perennials						
	barnyard grass	crabgrass	fall panicum	foxtails	witchgrass	buckwheat, wild	lady's-thumb	lamb's-quarters	mustards	nightshades	pigweeds	ragweed	velvetleaf	bindweed, field	horsetail	milkweed	nutsedge	quackgrass	sow-thistle	thistle, Canada
Soil Applied Grass and Broadleaf Herbicides																				
CHATEAU	3	3	3	5	3	–	7	9	–	9	9	7	7	–	–	–	–	–	–	–
COMMAND 360 ME	9	9	–	9	–	–	–	9	–	9	6	8/9	9	–	–	–	–	–	–	–
DACTHAL W-75	6	8	8	8	8	0	0	8	0	0	7	0	0	–	–	–	–	0	0	0
DUAL II MAGNUM	9	9	8	9	9	2	2	7	2	8	7/8	4	2	0	0	0	8	4	0	0
KARMEX or DIUREX 80WDG	9	8	7	8	–	8	8	9	8	7	8	9	–	–	5	–	5	5	5	5
KERB	8	8	8	8	8	–	6	6	7	7	0	0	0	0	0	0	0	0	0	0
NORTRON SC	7	6	7	7	7	8	8	8	8	7	8	8	7	5	5	5	6	5	5	5
PURSUIT	8	7	7	9	9	8	9	9	9	9	9	8	9	–	–	–	7	5	–	–
PRINCEP NINE-T **or** SIMAZINE 480 **or** SIMADEX	9	8	7	9	9	9	9	9	9	9	9	8	5	2	0	0	5	5	5	5
PROWL H2O	9	9	9	8	–	–	6	9	–	8	8	2	6	–	–	–	–	–	–	–
SENCOR or TRICOR	7	6	7	8	8	7	9	9	9	3	9	8	8	2	2	2	2	2	2	2
SINBAR	8	7	8	8	8	–	7	8	8	7	7	7	7	–	5	6	6	6	–	6
TREFLAN **or** RIVAL **or** BONANZA	9	9	9	9	9	5	7	8	2	2	8	4	2	2	2	2	2	2	2	2
Postemergence Grass Herbicides																				
ASSURE II or YUMA GL	9	8	9	9	9	0	0	0	0	0	0	0	0	0	0	0	0	9	0	0
EXCEL SUPER	9	8	9	9	9	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0
KERB	8	8	6	8	–	–	0	0	0	–	6	0	0	0	0	0	0	8	0	0
POAST ULTRA	9	8	9	9	9	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0
SELECT or CENTURION	9	8	9	8	9	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0

[1] Good control of these perennial weeds may require two applications, 7–10 days part.

[2] Yellow foxtail will only be suppressed.

[3] Registered for control of hairy nightshade.

[4] Repeated applications may be necessary if regrowth occurs.

[5] Weeds cannot be emerged at time of application to achieve this level of control.

[6] Registered for preemergent activity on common ragweed only

[7] Various formulations available, see Table 4–1. Herbicides Used in Ontario, page 30.

TABLE 13–1. Vegetable Herbicide Weed Control Ratings (cont'd)

LEGEND: Numbers (0–9) = weed control ratings – = insufficient information available to make a rating

	Grasses					Annual Broadleaves								Perennials						
Trade Name	**barnyard grass**	**crabgrass**	**fall panicum**	**foxtails**	**witchgrass**	**buckwheat, wild**	**lady's-thumb**	**lamb's-quarters**	**mustards**	**nightshades**	**pigweeds**	**ragweed**	**velvetleaf**	**bindweed, field**	**horsetail**	**milkweed**	**nutsedge**	**quackgrass**	**sow-thistle**	**thistle, Canada**
VENTURE L	8	8	9	8	9	0	0	0	0	0	0	0	0	0	0	0	0	8	0	0
Postemergence Broadleaf Herbicides																				
2,4–D[7]	0	0	0	0	0	7	4	4	9	7	9	8	8	7	0	0	0	0	8	8
AIM EC (Hooded Sprayer Appl'n.)	0	0	0	0	0	–	–	8	8	8	8	–	8	–	–	–	–	–	–	–
BASAGRAN FORTÉ	0	0	0	0	0	7	9	8	7	7	8	8	9	6[1]	2	2	8[1]	0	6[1]	7[1]
CALLISTO	8	4	2	2	2	8	9	9	9	9	9	7	9	2	0	0	0	0	0	0
GOAL 2XL	5	5	5	5	5	9	8	8	9	9	9	8	7	5	5	5	5	5	5	5
LONTREL	5	5	5	5	5	–	7	5	–	5	5	8	5	5	–	–	5	5	7	7
MCPA[7]	0	0	0	0	0	4	4	9	9	–	9	8	9	7	7	0	0	0	7	7
PARDNER **or** BROMOTRIL **or** BROTEX	0	0	0	0	0	9	9	9	8	9	8	9	9	7	0	0	0	0	7	7
PINNACLE SG	0	0	0	0	0	–	8	9	8	3	9	5	8	2	2	2	2	2	2	2
PYRAMIN	5	5	–	5	–	8	8	8	8	8	8	8	–	–	5	–	5	5	5	5
TROPOTOX PLUS **or** CLOVITOX PLUS **or** TOPSIDE	0	0	0	0	0	8	8	7	8	7	9	9	9	8	0	0	0	0	8	8
Postemergence Grass and Broadleaf Herbicides																				
BETAMIX B	5	5	5	7	5	6	6	8	7	6	8	8	5	5	–	–	5	5	5	5
LOROX DF or L	9	7	9	8	9	8	8	8	8	8	8	8	8	7	8	7	8	7	8	7
PRISM	9	8	9	8[2]	9	–	7	7	9	4[3]	9	3	6	–	–	–	–	7	–	–
SANDEA	0	0	0	0	0	–	8[5]	8[5]	8	–	8	8	8	6	6	7	9	–	–	–
SENCOR	8	7	9	8	9	7	9	8	9	–	8	8	7	–	–	–	–	7	–	–
TITUS PRO	9	8	9	8	9	7	9	8	9	4[3]	9	8	7	–	–	–	–	7	–	–
Postemergence Tank-Mix Options																				
PRISM + PINNACLE SG	9	8	9	8[2]	9	–	8	9	9	4[3]	9	5	8	2	2	2	2	7	2	2
Preharvest and Postharvest																				
IGNITE	9	9	9	9	9	–	9	9	9	–	9	9	9	8[4]	7[4]	6[4]	0	8[4]	–	–

[1] Good control of these perennial weeds may require two applications, 7–10 days part.

[2] Yellow foxtail will only be suppressed.

[3] Registered for control of hairy nightshade.

[4] Repeated applications may be necessary if regrowth occurs.

[5] Weeds cannot be emerged at time of application to achieve this level of control.

[6] Registered for preemergent activity on common ragweed only

[7] Various formulations available, see Table 4–1. Herbicides Used in Ontario, page 30.

More than 50 vegetable crops are grown commercially in Ontario. Some are seeded, some transplanted, some are annuals, and other crops are perennial, presenting a very diverse group of situations to manage weeds. Weed management involves all aspects of weed control in vegetable crops including scouting, herbicides, cultivation, hoeing, mulches, etc.

Perennial weeds are often a more severe problem in perennial horticultural crops, such as asparagus and need to be controlled prior to planting.

Information for snap beans and sweet corn are listed in the field crop section (Beans, Chapter 7, page 101 and Corn, Chapter 9, page 127) because they are similar to those for field corn and field beans. Differences are noted where necessary.

Treatments listed for horticultural crops in this publication are based on extensive research trials. Do not use herbicides in cold frames or greenhouses unless specifically stated on the pesticide label.

Horticultural crops are often high value crops. Weed competition is costly. Improper application of herbicides can also be costly. Sprayers used for hormone type herbicides (2,4-D, etc.) should not be used to apply insecticides, fungicides or other herbicides on susceptible horticultural crops.

Herbicide Application Timings

Preplant (PP) Treatments

Preplant treatments are applied before the crop is sown or planted. Some of these herbicides kill seedlings soon after germination while others also kill weed seeds. Most herbicides used for these treatments must be thoroughly incorporated into the soil by cultivation soon after application. Check the label. Also see Chapter 6 *Preplant & Postharvest Weed Control,* page 91, for details of products, rates and remarks.

Preplant (PP) Weed and Cover Crop Control

Control cover crops and emerged weeds before seeding or transplanting vegetable crops. Refer to Table 6–1. *Non-Selective Herbicides Available for Preplant Site Preparation,* page 91. Alternatively, a grower may choose to kill the cover crop and/or emerged weeds just before planting the vegetable crop and either till the area or leave the seedbed untilled.

Preplant Incorporated (PPI)

Two incorporations at right angles operating at a depth of 10 cm using a double disk (7–10 km/h) or vibrating shank S-tine cultivator (10–13 km/h) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Special attention should be directed toward machinery cleanliness and/or treating fields with perennial weeds last.

Preemergence (PRE)

Rainfall at 15–20 mm within 7–10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improves herbicide activity in the absence of rainfall. These materials prevent emergence of many weed seedlings without reducing crop stand. Apply immediately after seeding or at least before the emergence of the crop. If these materials are applied after weeds have emerged, kill is usually poor. Best results are obtained with this method when conditions for weed seed germination are good.

Postemergence (POST)

These chemicals are applied after the crop plants have sprouted or after the crop has been transplanted. Applied as directed, the weeds can be killed without injury to the crop. Leaf stage of the weeds is critical for good weed control. Smaller weeds are generally easier to kill but there needs to be enough leaf surface to intercept the herbicide. Apply according to leaf stages specified on the pesticide label. Crop stage is important to optimize crop safety. Adjuvants will frequently improve the weed control when used as directed. Weather or other conditions may influence the optimum rate of adjuvant, see the product label for more details. Always use appropriate drift management technology.

Inter-Row Weeding

The herbicide is directed between the crop rows onto the emerged weeds. The herbicide is used as a rescue operation where other methods of weed control have failed. Use special low pressure (7–15 kpa) applicators such as dribble bars or vibra jets equipped with shields to prevent wetting the crop. See Stale Seedbed and Inter-Row Weeding, page 96.

Stale Seedbed Technique

The stale seedbed technique is useful when the soil can be worked well before planting and weeds are allowed to emerge for several weeks. Apply one of the non-selective herbicides listed under the Stale Seedbed and Inter-Row Weeding, page 96. Seeding or planting directly into the killed weeds with minimal soil disturbance will allow the crop to establish before the next flush of weed emergence. Follow up with either cultivation, hoeing or postemergent or directed herbicides to control later germinating weeds. Where registered, some herbicides can be applied after seeding but before crop emergence.

Wiper Applicators for Selective Weed Control

Wiper applicators (rope-wick, roller applicator or similar device) have been extensively used with glyphosate. Check product labels for use of this application technique with other herbicides.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
ASPARAGUS			
Site Preparation Before Planting – See Chapter 6, Preplant & Postharvest Weed Control, page 91.			
Preplant (Stale Seedbed Technique)			
s-metolachlor/benoxacor (1.42–1.6 kg/ha)	DUAL II MAGNUM (915 g/L)	1.55–1.75 L/ha (0.6–0.7 L/acre)	• **Apply before direct seeded or established spears emerge.** • Application may result in injury to the asparagus crop, which may include potential stand loss, delayed maturity and even loss of yield. • Apply as a ground application only. • Use **ONLY** 1 application per year. • **Do NOT** apply to soil with less than 1% or more than 10% organic matter.
paraquat (0.55–1.1 kg/ha) followed by napropamide (2.25–4.5 kg/ha)	GRAMOXONE (200 g/L)	2.75–5.5 L/ha (1.1–2.2 L/acre))	• **Apply before direct seeded or seedling spears emerge.** • Apply in 300–1,100 L/ha (120–440 L/acre) water. Use the higher volume of water on dense weed growth. • Spray GRAMOXONE to kill emerged seedling weeds before the first asparagus seedlings begin to emerge. • Apply DEVRINOL as a separate application just before a second flush of weeds emerge.
	GRAMOXONE (200 g/L) followed by DEVRINOL DF (50 DF)	2.75–5.5 L/ha (1.1–2.2 L/acre) 4.5–9 kg/ha (1.8–3.6 kg/acre)	
	GRAMOXONE (200 g/L) followed by DEVRINOL DF-XT (50 DF-XT)	2.75–5.5 L/ha (1.1–2.2 L/acre) 4.5–9 kg/ha (1.8–3.6 kg/acre)	
glufosinate ammonium (0.405–0.75 kg/ha)	IGNITE (150 g/L)	2.7–5 L/ha (1.08–2 L/acre)	• **Apply before direct seeded or established spears emerge.** • Apply in 110–330 L/ha (44–132 L/acre) water. • Spray uniformly on emerged weeds prior to emergence of the crop. • Weeds that have not emerged will not be controlled.
glyphosate (0.45–0.9 kg/ha)	glyphosate (360 g/L)*	1.25–2.5 L/ha (0.5–1 L/acre)	• **2nd year and established plantings ONLY.** • For control of fall-seeded rye and emerged weeds. • Apply in the spring before spears emerge, but not closer than 7 days to harvest. • Use **ONLY** 1 application per year.
	glyphosate (480 g/L)*	0.94–1.875 L/ha (0.38–0.75 L/acre)	
	glyphosate (500 g/L)*	0.9–1.8 L/ha (0.36–0.72 L/acre)	
	glyphosate (540 g/L)*	0.83–1.67 L/ha (0.33–0.67 L/acre)	* See Table 4–1. Herbicides Used in Ontario, page 30, for formulations available. Not all formulations registered on all crops. See label for specific uses and rates.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
ASPARAGUS (cont'd)			
Soil Applied Grass and Broadleaf Herbicides			
flumioxazin (0.14–0.21 kg/ha)	CHATEAU WDG (51.1%)	0.28–0.42 kg/ha (0.11–0.16 kg/acre)	• **1st year crown and established plantings ONLY.** · Apply ONCE per season to dormant asparagus established for at least 1 year. · Apply prior to weed emergence. · Apply lower rate on sandy (coarse textured) soils with less than 5% organic matter and the higher rate on clay (medium textured) with less than 5% organic matter. · Injury may result if spears emerge before the application has been activated with water. · Apply by ground application **ONLY**. · After use, tanks and nozzles must be cleaned with a 3% ammonia solution. Please review label for more detailed instructions.
napropamide (2.25–4.5 kg/ha)	DEVRINOL DF (50 DF)	4.5–9 kg/ha (1.8–3.6 kg/acre)	• **Seedlings and new plantings ONLY.** · PPI – Incorporation by irrigation or rainfall is essential. · Treat at planting time, or soon after planting before weed seedlings appear. · Use lower rate on sandy soils and the higher rate on clay soils.
	DEVRINOL DF-XT (50 DF-XT)		
diuron (8.8–3.6 kg/ha)	KARMEX (80 DF)	1.1–4.5 kg/ha (0.44–1.8 kg/acre)	• **2nd year and established plantings ONLY.** · PRE – Disk before any shoots appear in the spring on established plantings. · A second application may be made after the postharvest disking. · Use lower rates for lighter soils. · Rates are given for overall sprays; reduce proportionately if only rows are sprayed. · **Do NOT** apply if you are planning to take the crop out of production after harvest. · If two applications are being made, **do not** exceed 3.25 kg/ha on each application. · If using irrigation, only apply 1 application of 4.5 kg/ha.
	DIUREX 80WDG		
linuron (1.6–2.15 kg/ha)	LOROX DF (50 DF)	3.3–4.3 kg/ha (1.32–1.72 kg/acre)	• **2nd year and established plantings ONLY.** · PRE – Disk before any shoots appear in the spring on established plantings. · A second application may be made after the postharvest disking. · Use lower rates for lighter soils. · Rates are given for overall sprays; reduce proportionately if only rows are sprayed.
linuron (1.6–2.15 L/ha)	LOROX L (480 g/L)	3.3–4.3 L/ha (1.32–1.72 L/acre)	
metribuzin (1.125 kg/ha)	SENCOR 75 DF (75 WG)	1.5 kg/ha (0.6 kg/acre)	• **2nd year and established plantings ONLY.** · PRE – Disk before any shoots appear in the spring on established plantings. · A second application may be made after postharvest disking. · Use lower rates for lighter soils. · Rates are given for overall sprays, reduce proportionately if only rows are sprayed. · Apply in 100–300 L/ha water. · **Do NOT** harvest for 24 days after application.
	TRICOR 75 DF (75%)		

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
ASPARAGUS (cont'd)			
Soil Applied Grass and Broadleaf Herbicides (cont'd)			
simazine (2.25–3.38 kg/ha) + napropamide (4.5–6.7 kg/ha)	PRINCEP NINE-T (90 WG) + DEVRINOL DF (50 DF)	2.5–3.75 kg/ha (1–1.5 kg/acre) + 9–13.4 kg/ha (3.6–5.36 kg/acre)	• **2nd year and established plantings ONLY.** • PRE – Disk before any shoots and weeds appear in the spring on established plantings. • Use lower rates for lighter soils. • Make no more than two applications per season. • Apply second application after postharvest disking. • Apply in 300 L/ha of water. • **Do NOT** apply within 6 days of harvest. • **Do NOT** apply during the cutting season. • **Do NOT** apply if heavy rain is expected.
	PRINCEP NINE-T (90 WG) + DEVRINOL DF-XT (50 DF-XT)		
simazine (2.25–3.4 kg/ha)	PRINCEP NINE-T (90 WG)	2.5–3.75 kg/ha (1–1.5 kg/acre)	• **Established plantings ONLY.** • PRE – Apply preemergence to crop and weeds, 7 days before first cutting. • A second application may be made after postharvest disking. • Use lower rates for lighter soils. • Rates are given for overall sprays; reduce proportionately if only rows are sprayed. • **Do NOT** apply if you are planning to take the crop out of production after harvest. • **Do NOT** apply if heavy rain is expected. • **Do NOT** apply during cutting season.
	SIMADEX (500 g/L)	4.5–6.7 L/ha (1.8–2.68 L/acre)	
	SIMAZINE 480 (480 g/L)	4.7–7 L/ha (1.88–2.8 L/acre)	
terbacil (0.3 kg/ha)	SINBAR (80 WP)	0.375 kg/ha (0.15 kg/acre)	• **2nd year and established plantings ONLY.** • PRE – Apply before spears emerge, or immediately after clean cutting. • Apply only once throughout the entire growing season. • Apply before weeds emerge, or to small, actively growing weeds (up to 5 cm). • **Do NOT** use on soils containing less than 1% organic matter, or where subsoil or roots are exposed. • **Do NOT** use on plants that are weak or diseased, or lacking in vigor (slow growing). • **Do NOT** harvest within 5 days of treatment. • Treated areas may be replanted to asparagus the following year after application. • **Do NOT** plant any other crop for 2 years.
	SINBAR (80 WDG)		
trifluralin (1–2 kg/ha)	TREFLAN EC (480 g/L)	2–4.2 L/ha (0.8–1.68 L/acre)	• **Established plantings ONLY.** • PPI – Application should occur early enough in the spring to ensure that spears are not injured by the required incorporation (5–10 cm) or apply after last cutting of spears (postharvest disking) and incorporate. • Established plantings of 3 years or more **ONLY.** • Apply the higher rates to heavy clay soils.
	RIVAL EC (500 g/L)	2–4 L/ha (0.8–1.6 L/acre)	
	BONANZA 480 (480 g/L)	2.1–4.2 L/ha (0.84–1.68 L/acre)	

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
ASPARAGUS (cont'd)			
Postemergence Grass Herbicides			
fenoxaprop-p-ethyl (0.054 kg/ha)	EXCEL SUPER (80.5 g/L)	0.67 L/ha (0.27 L/acre)	· **2nd year and established plantings ONLY**. · Apply to asparagus **ONLY** after the spears have been harvested. · **Do NOT** treat spears prior to or during harvest. · Apply when majority of annual grasses are in the 1–6 leaf stage or until volunteer corn is up to 25 cm tall. · Grasses emerging after application will not be controlled.
sethoxydim (0.14–0.5 kg/ha) + surfactant/solvent (0.25–2 L/ha)	POAST ULTRA (450 g/L) + MERGE	0.32–1.1 L/ha (0.13–0.44 L/acre) + 0.25–2 L/ha (0.1–0.8 L/acre)	· **Apply to direct seeded, 1st year crown, 2nd year and established plantings**. · For annual grass, use 0.32 L/ha. Apply at the 1–6 leaf stage (2–5 is optimum). · For volunteer grains, use 0.47 L/ha. Apply at the 1–6 leaf stage (1–4 is optimum). · For quackgrass, use 1.1 L/ha. Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days in wide row crops. Use the high rate of MERGE for quackgrass. · Use 100–200 L water/ha (40–80 L water/acre). · Grasses emerging after application will not be controlled. · Spray tips angled forward 45° will give better coverage. · **Do NOT** use flood jet or hollow cone nozzles. · **Do NOT** apply if rain is expected within 1 h after application. · Preharvest interval is 40 days.
fluazifop-p-butyl (0.075–0.25 kg/ha)	VENTURE L (125 g/L)	0.6–2 L/ha (0.24–0.8 L/acre)	· **Apply to direct seeded, 1st year crown and established plantings.** · Apply POST to actively growing grasses before tillering. · Apply 1 application per season only. · Apply at 0.6 L/ha (0.24 L/acre) at 2–5 leaf stage of volunteer corn. · Apply at 0.8 L/ha (0.32 L/acre) at 2–5 leaf stage of volunteer wheat and barley. · Apply at 1 L/ha (0.4 L/acre) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails). · Apply at 2 L/ha (0.8 L/acre) at 3–5 leaf stage of quackgrass and wirestem muhly. · Thorough preplant tillage, fragmenting quackgrass rhizomes improves control. · **Do NOT** cultivate between rows until 5 days after application. · Preharvest interval is 1 day.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
ASPARAGUS (cont'd)			
Postemergence Broadleaf Herbicides			
2,4-D* (1–1.6 kg/ha)	2,4-D (470 g/L)*	3.5 L/ha (1.4 L/acre)	- **2nd year and established plantings ONLY.** - After last cutting immediately after harvest or 3 weeks after the post cutting disking. Direct spray to avoid wetting the asparagus fern. - Apply in 50–200 L/ha (20–80 L/acre) water. - May be applied early in the season just after a cutting. - Spray immediately after harvest to avoid injury. - Emerging spears may be twisted and should be discarded. Later emerging spears will be normal. * See Table 4–1. Herbicides Used in Ontario, page 30, for formulations available. Not all formulations registered on all crops. See label for specific uses and rates.
	2,4-D (564 g/L)*	1.7–2.25 L/ha (0.68–0.9 L/acre)	
	2,4-D (660 g/L)*	1.96 L/ha (0.78 L/acre)	
mesotrione (0.14 kg/ha)	CALLISTO (480 g/L)	0.30 L/ha (0.12 L/acre)	- Apply after fern mowing, disking, or other tillage operation but prior to spear emergence (PRE). - If weeds are emerged at the time of application add AGRAL 90 at a rate of 0.2% v/v. If weeds have not emerged, no adjuvant is needed. - One application per year **ONLY** in 100–200 L/ha (40–80 L/acre) water at 206–300 kPa. - **Do NOT** apply by air. **Do NOT** enter or allow worker entry into treated areas during the restricted entry interval (REI) of 12 hr.
halosulfuron (25–76 g/ha)	SANDEA (72.6 WG)	35–105 g/ha (14–42.5 g/acre)	- **Post transplant and established plantings.** - For first year plantings, apply no sooner than six weeks after fern emergence. - Apply as a single or double application of 35–105 g/ha, allow a minimum of 21 days between applications. - **Do NOT** apply more than 140 g/ha (56 g/acre) per season. - Use a minimum water volume of 140 L/ha (56 L/acre). - **Do NOT** spray over top of plastic mulch. - **Do NOT** harvest within 1 day after application.
Postemergence Grass and Broadleaf Herbicides			
terbacil (0.3 kg/ha)	SINBAR (80 WP)	0.38 kg/ha (0.15 kg/acre)	- **Apply before emergence of direct seeded asparagus ONLY.** - PRE – Apply as a broadcast treatment within 2 days of seeding. - Plant asparagus seed to a depth of 4 cm in coarse (sandy) soils or 2.5 cm deep in fine (clay) soils into newly cultivated fields.
	SINBAR (80 WDG)		

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	**TRADE NAME (concentration)**	**PRODUCT RATE**	**PRECAUTIONS** **For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.**
ASPARAGUS (cont'd)			
Post Harvest Herbicides			
s-metolachlor/benoxacor (1.42–1.6 kg/ha)	DUAL II MAGNUM (915 g/L)	1.55–1.75 L/ha (0.6–0.7 L/acre)	• **Apply after last cutting of established asparagus.** · Application may result in injury to the asparagus crop, which may include potential stand loss, delayed maturity and even loss of yield. · Apply as a ground application **ONLY**. · Use **ONLY** 1 application per year. · **Do NOT** apply to soil with less than 1% or more than 10% organic matter.
paraquat (0.55–1.1 kg/ha) followed by napropamide (2.25–4.5 kg/ha)	GRAMOXONE (200 g/L)	2.75–5.5 L/ha (1.1–2.2 L/acre)	• **Apply after last cutting of established asparagus.** · Apply in 300–1,100 L/ha (120–440 L/acre) water. Use the higher volume of water on dense weed growth.
	GRAMOXONE (200 g/L) followed by DEVRINOL DF (50 DF)	2.75–5.5 L/ha (1.1–2.2 L/acre) 4.5–9 kg/ha (1.8–3.6 kg/acre)	
	GRAMOXONE (200 g/L) followed by DEVRINOL DF-XT (50 DF-XT)		
glufosinate ammonium (0.405–0.75 kg/ha)	IGNITE (150 g/L)	2.7–5 L/ha (1.08–2 L/acre)	• **Apply after last cutting of established asparagus.** · Apply in 110–330 L/ha (44–132 L/acre) water.
glyphosate (0.45–0.9 kg/ha)	glyphosate (360 g/L)*	1.25–2.5 L/ha (0.5–1 L/acre)	• **2nd year and established plantings ONLY.** · Use **ONLY** 1 application per year.
	glyphosate (480 g/L)*	0.94–1.875 L/ha (0.38–0.75 L/acre)	
	glyphosate (500 g/L)*	0.9–1.8 L/ha (0.36–0.72 L/acre)	* See Table 4–1. Herbicides Used in Ontario, page 30, for formulations available. Not all formulations registered on all crops. See label for specific uses and rates.
	glyphosate (540 g/L)*	0.83–1.67 L/ha (0.33–0.67 L/acre)	
halosulfuron (25–76 g/ha) + non-ionic surfactant (0.2% v/v)	SANDEA (72.6 WG) + non-ionic surfactant	35–105 g/ha (14–42.5 g/acre) 2 L/1000 L	• **Post transplant and established plantings.** · Apply as a single or split application of 35–105 g/ha (14–42 g/acre), allow a minimum of 21 days between applications. · **Do NOT** apply more than 140 g/ha (56 g/acre) per season. · For nutsedge control, split applications will provide better control if weed pressure is heavy. · Use a minimum water volume of 140 L/ha insert (56 L/acre). · Drop nozzles will minimize crop injury and increase the control of weeds. · **Do NOT** spray over top of plastic mulch. · **Do NOT** harvest within 1 days after application.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
BEANS (LIMA AND SNAP) – See Chapter 7, Beans, page 101.			
BEETS (SUGAR) – See Sugar Beets (Processing), page 312.			
BEETS (RED)			
Site Preparation Before Planting – See Chapter 6, Preplant & Postharvest Weed Control, page 91.			
Soil Applied Broadleaf Herbicide			
pyrazon (3.54–4.4 kg/ha)	PYRAMIN FL (430 g/L)	8.25–10.25 L/ha (3.3–4.1 L/acre)	· PPI or PRE. · PPI – **Do NOT** incorporate more than 5 cm. · PRE – Apply in 150–300 L/ha (60–120 L/acre) water. · **Do NOT** use on soils with less than 3% organic matter. · Rainfall or irrigation is required to activate the herbicide.
Soil Applied Grass and Broadleaf Herbicide			
s-metolachlor/benoxacor (1.14 kg/ha)	DUAL II MAGNUM (915 g/L)	1.25 L/ha (0.5 L/acre)	· Pre-emergent to weeds. · Apply **ONLY** as a ground application in 150 L water/ha minimum. · Use **ONLY** 1 application per year. · Irrigate after application to activate the herbicide if rainfall is not expected, but use only 0.5 inches of water to incorporate the herbicide. Excessive irrigation will increase the risk of crop injury. Mechanical incorporation of DUAL II MAGNUM will increase the risk of crop injury. • **DO NOT** use DUAL II MAGNUM if the planting operation creates a furrow or trough over the seed-row into which rain or irrigation water will collect and thus concentrate the herbicide over the row. · Application may result in crop injury.
Postemergence Grass Herbicides			
clethodim (46–91 g/ha) + surfactant (0.5–1% v/v)	SELECT (240 g/L) + AMIGO CENTURION (240 g/L) + AMIGO	0.19–0.38 L/ha (0.08–0.15 L/acre) + 5–10 L/1,000 L	· For the control of annual grasses and quackgrass. · See label for detailed information on rates to control all annual grasses. · Apply using ground equipment. · Apply in a minimum of 110 L/ha (44 L/acre) water for SELECT. · Apply in a minimum of 200 L/ha (80 L/acre) water for CENTURION. · Apply when grassy weeds are at 2–6 leaf stage. · **Do NOT** exceed 2 applications per year and 0.38 L/ha. · **Do NOT** apply within 30 days of harvest.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
BEETS (RED) (cont'd)			
Postemergence Broadleaf Herbicides			
carfentrazone-ethyl (8.8–28.1 g/ha) + non-ionic surfactant (0.25% v/v)	AIM EC (240 g/L) + AGRAL 90	36.5–117 mL/ha (14.6–46.8 mL/acre) + 2.5 L/1,000 L	• Apply POST with a hooded sprayer between the rows or between the plastic mulch. • Apply to actively growing weeds up to 10 cm tall. • Apply in a minimum of 100 L/ha (40 L/acre) water. • **Do NOT** apply closer than 1 day to harvest. • Apply **ONLY** once per growing season.
	AIM EC (240 g/L) + AG-SURF	36.5–117 mL/ha (14.6–46.8 mL/acre) + 2.5 L/1,000 L	
carfentrazone-ethyl (8.8-28.1 g/ha) + surfactant/solvent (0.1% v/v)	AIM EC (240 g/L) + MERGE	36.5–117 mL/ha (14.6–46.8 mL/acre) + 1 L/1,000 L	
pyrazon (3.54 kg/ha) + surfactant (0.25% v/v)	PYRAMIN FL (430 g/L) + CITOWETT PLUS	8.25 L/ha (3.3 L/acre) + 2.5 L/1,000 L	• For best results, apply before the third true leaf of crop and weeds. • Apply in 300–400 L/ha (120–160 L/acre) water. • **Do NOT** use any other oils or surfactants, including ASSIST or MERGE or crop injury may result.
triflusulfuron-methyl (17.5–35 g/ha) + non-ionic surfactant (0.25% v/v)	UPBEET (50 DF) + AGRAL 90	35–70 g/ha (14–28 g/acre) + 2.5 L/1,000 L	• Apply at the 2–4, 4–6, and the 6–8 leaf stages. Use the higher rate for larger weeds and heavy weed populations. UPBEET may be applied up to three times a year. • **Do NOT** use more than 108 g/ha (43.2 g/acre) of UPBEET in a season. • **Do NOT** apply under extreme temperatures or drought conditions. • **Do NOT** spray if rainfall is expected within 6 hr. • Yellowing of the crop may occur, but beets will recover. • Preharvest interval is 30 days.
triflusulfuron-methyl (17.5–35 g/ha) + adjuvant (0.25% v/v)	UPBEET (50 DF) + AGSURF		
	UPBEET (50 DF) + CITOWETT PLUS		
Postemergence Grass and Broadleaf Herbicides			
desmedipham/ phenmedipham (0.18–0.28 kg/ha)	BETAMIX B EC ((1:1) 153 g/L)	1.15–1.75 L/ha (0.46–0.7 L/acre)	• The first application must be made when the weeds have reached the cotyledon stage. Kochia must be sprayed during the rosette stage. Wait 5–7 days before repeating application. • Apply in 100–200 L/ha (40–80 L/acre) water. • **Do NOT** spray more than 5.25 L/ha (2.1 L/acre) of BETAMIX per year. Apply no more than three treatments. • **Do NOT** spray under extreme temperature or drought conditions. • **Do NOT** spray if dew is present. • **Do NOT** spray if rainfall is expected within 6 hr. • Temporary reduced growth and/or tip burn may occur. Beets will resume growth in 10 days. • Preharvest interval is 30 days.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
CABBAGE, CAULIFLOWER, BROCCOLI, BRUSSELS SPROUTS			
Site Preparation Before Planting – See Chapter 6, Preplant & Postharvest Weed Control, page 91.			
Soil Applied Grass Herbicides			
napropamide (1.12–2.25 kg/ha)	DEVRINOL DF (50 DF)	2.25–4.5 kg/ha (0.9–1.8 kg/acre)	· PPI or PRE – Use **ONLY** on transplanted cabbage, cauliflower, and broccoli. · Use **ONLY** 1 application per year. · Use the lower rate on light soils (coarse textured sandy and sandy loam). · Apply to well worked soil that is dry enough to permit thorough incorporation to a depth of 2.5–5.0 cm. Incorporate the same day as applied. · Damage to subsequent cover crops can be reduced by tillage across the rows after harvest. Small grains seeded in the fall may be stunted but not otherwise affected. · **Do NOT** harvest within 60 days.
	DEVRINOL DF-XT (50 DF-XT)		
s-metolachlor/benoxacor (1.14–1.6 kg/ha)	DUAL II MAGNUM (915 g/L)	1.25–1.75 L/ha (0.5–0.7 L/acre)	· PRE to weeds – Apply after transplanting within 2 days, before weeds emerge. · Use the higher rate for heavier weed pressure. · Use **ONLY** 1 ground application per year in 300 L water/ha. · **Do NOT** incorporate and **do not** use on seeded cole crops. · **Do NOT** apply to soil with less than 1% or more than 10% organic matter. · Use **ONLY** on transplanted cabbage, cauliflower and broccoli.
Soil Applied Grass and Broadleaf Herbicides			
chlorthal dimethyl (6.75–11.63 kg/ha)	DACTHAL W-75 (75 WP)	9–15.5 kg/ha (3.6–6.2 kg/acre)	· PPI or PRE. · Apply in at least 225 L/ha (90 L/acre) of water at a rate of 9–13.5 kg/ha (3.6–5.4 kg/acre) on light sand or sandy loam soils and at a rate of 11–15.5 kg/ha (4.4–6.2 kg/acre) on medium silt loam soils. **Do NOT** use on muck soils. · Apply immediately after seeding or directly over transplants, preemergence to weeds. If weeds have emerged, cultivate the soil before application. · Rainfall or irrigation (about 1 cm) is necessary for activation.
dimethenamaid (544–693 g/ha)	FRONTIER MAX (900 g/L)	756–963 mL/ha (305–390 mL/acre)	· For use on transplanted cabbage **ONLY.** · Apply to soil prior to transplant and before weed emergence. · **Do NOT** harvest within 60 days of application.
trifluralin (0.6–1.15 kg/ha)	TREFLAN EC (480 g/L)	1.2–2.4 L/ha (0.5–0.96 L/acre)	· PPI. · Use **ONLY** on direct seeded cabbage or cauliflower or on transplants of cabbage, cauliflower, broccoli and Brussels sprouts.
	RIVAL EC (500 g/L)	1.2–2.3 L/ha (0.5–0.92 L/acre)	
	BONANZA 480 (480 g/L)	1.25–2.3 L/ha (0.5–0.92 L/acre)	

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
CABBAGE, CAULIFLOWER, BROCCOLI, BRUSSELS SPROUTS (cont'd)			
Postemergence Grass Herbicides			
fenoxaprop-p-ethyl (0.054 kg/ha)	EXCEL SUPER (80.5 g/L)	0.67 L/ha (0.27 L/acre)	• **Do NOT** use on Brussels sprouts. • Apply when the majority of annual grasses are in the 1–6 leaf stage or until volunteer corn is up to 25 cm tall. Grasses emerging after application will not be controlled. • The preharvest interval for cabbage is 35 days, broccoli 44 days and cauliflower 43 days.
sethoxydim (0.15–0.5 kg/ha) + surfactant/solvent (0.25–2 L/ha)	POAST ULTRA (450 g/L) + MERGE	0.32–1.1 L/ha (0.13–0.44 L/acre) + 0.25–2 L/ha (0.1–0.8 L/acre)	• **Do NOT** exceed 0.45 L/ha (0.18 L/acre) on broccoli. • For annual grass, use 0.32 L/ha (0.19 L/acre) at the 1–6 leaf stage. • For volunteer grains, use 0.47 L/ha (0.19 L/acre). • For quackgrass, use 1.1 L/ha (0.44 L/acre). Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days in wide row crops. Use the high rate of MERGE for quackgrass. • Use 100–200 L/ha (40–80 L/acre) water. • **Do NOT** apply closer than 70 days to harvest.
fluazifop-p-butyl (0.075–0.25 kg/ha)	VENTURE L (125 g/L)	0.6–2 L/ha (0.24–0.8 L/acre)	• Apply **ONLY** 1 POST application per season only to actively growing grasses before tillering. • Apply at 0.6 L/ha (0.24 L/acre) at 2–5 leaf stage of volunteer corn. • Apply at 0.8 L/ha (0.32 L/acre) at 2–5 leaf stage of volunteer wheat and barley. • Apply at 1 L/ha (0.4 L/acre) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails). • Apply at 2 L/ha (0.8 L/acre) at 3–5 leaf stage of quackgrass and wirestem muhly. • Thorough preplant tillage, fragmenting quackgrass rhizome improves control. • **Do NOT** cultivate between rows until 5 days after application. • **Do NOT** harvest for 40 days after application.
Postemergence Broadleaf Herbicides			
carfentrazone-ethyl (8.8–28.1 g/ha) + non-ionic surfactant (0.25% v/v)	AIM EC (240 g/L) + AGRAL 90 or AG-SURF	36.5–117 mL/ha (14.6–46.8 mL/acre) 2.5 L/1,000 L 2.5 L/1,000 L	• Apply **ONLY** 1 POST application per growing season with a hooded sprayer between the rows. • Apply to actively growing weeds up to 10 cm tall. • Apply in a minimum of 100 L/ha (40 L/acre) water. • **Do NOT** apply closer than 1 day to harvest.
	AIM EC (240 g/L) + AG-SURF	36.5–117 mL/ha (14.6–46.8 mL/acre) + 2.5 L/1,000 L	
carfentrazone-ethyl (8.8–28.1 g/ha) + surfactant/solvent (0.1% v/v)	AIM EC (240 g/L) + MERGE	36.5–117 mL/ha (14.6–46.8 mL/acre) + 1 L/1,000 L	
oxyfluorfen (252–446 mL/ha)	GOAL 2XL (22.3%)	1.13–2.0 L/ha (0.46–0.81 L/acre)	• Applied once pre-transplant (preplant). • Can be applied in a minimum of 200 L/ha (80 L/acre). Apply after completion of soil preparation but prior to transplanting. • **Do NOT** apply to broccoli, cabbage or cauliflower within 60 days of harvest.
clopyralid (0.20 kg/ha)	LONTREL 360 (360 g/L)	0.56 L/ha (0.2 L/acre)	• Use **ONLY** on transplanted cabbage, cauliflower and broccoli. • Apply POST transplant as a ground application **ONLY**, in 300 L/ha (120 L/acre) water. • Use **ONLY** 1 application per year, no closer than 30 days to harvest.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
CARROTS			
Site Preparation Before Planting – See Chapter 6, Preplant & Postharvest Weed Control, page 91.			
Soil Applied followed by Postemergence Grass and Broadleaf Herbicides			
linuron (1.125 L/ha) followed by metribuzin 0.143 kg/ha	LOROX (480 g/L) SENCOR 75 DF (75%)	2.25 L/ha (0.9 L/acre) followed by 0.19 kg/ha (0.077 kg/acre)	• To be used only on carrots previously treated with a PRE application of linuron. • **Do NOT** tank-mix with liquid fertilizers, oils, oil concentrates, or surfactants when applying postemergence because severe crop injury may occur. • **Do NOT** harvest within 60 days of postemergence application unless otherwise indicated. • On sunny days application should be made in the afternoon or early evening. • **Do NOT** apply on coarse soils with less than 2% organic matter.
trifluralin (0.6–1.15 kg/ha) followed by linuron (0.55–1.625 kg/ha)	TREFLAN EC (480 g/L) followed by LOROX DF (50 DF)	1.25–2.4 L/ha (0.5–0.96 L/acre) followed by 1.1–3.25 kg/ha (0.44–1.3 kg/acre)	• Apply trifluralin PPI followed by LOROX L POST on mineral soils. • Spray linuron when crop has 2 or more fully developed leaves (8–15 cm tall). • Apply POST before annual grasses are 5 cm high and before broadleaf weeds are 15 cm high. • Carrot leaves will become yellow or light green, but they soon recover. • Use nozzle pressure of 175–275 kPa. **Do NOT** exceed 275 kPa. • **Do NOT** apply linuron with herbicidal oil. • **Do NOT** apply linuron during hot, dry weather (greater than 32°C) or when crop is under stress. • **Do NOT** apply linuron if heavy rains are expected. • Use the lower rates on sandy soils and for smaller weeds. • **Do NOT** use on coarse-textured soils low in organic matter or on soils that contain more than 15% organic matter.
	RIVAL EC (500 g/L) followed by LOROX DF (50 DF)	1.2–2.3 L/ha (0.5–0.92 L/acre) followed by 1.1–3.25 kg/ha (0.44–1.3 kg/acre)	
	BONANZA 480 (480 g/L) followed by LOROX DF (50 DF)	1.25–2.3 L/ha (0.5–0.92 L/acre) followed by 1.1–3.25 kg/ha (0.44–1.3 kg/acre)	
trifluralin (0.6–1.15 kg/ha) followed by linuron (0.55–1.625 L/ha)	TREFLAN EC (480 g/L) followed by LOROX L (480 g/L)	1.25–2.4 L/ha (0.5–0.96 L/acre) followed by 1.1–3.25 L/ha (0.44–1.3 L/acre)	
	RIVAL EC (500 g/L) followed by LOROX L (480 g/L)	1.2–2.3 L/ha (0.5–0.92 L/acre) followed by 1.1–3.25 L/ha (0.44–1.3 L/acre)	
	BONANZA 480 (480 g/L) followed by LOROX L (480 g/L)	1.25–2.3 L/ha (0.5–0.92 L/acre) followed by 1.1–3.25 L/ha (0.44–1.3 L/acre)	
prometryne (1.8–3.4 kg/ha) followed by linuron (0.55–1.125 kg/ha)	GESAGARD 480 SC (480 g/L) followed by LOROX DF (50 DF)	3.75–7.08 L/ha (1.5–2.83 L/acre) followed by 1.1–2.25 kg/ha (0.44–0.9 kg/acre)	• PRE followed by POST – Use on muck soils **ONLY**. • For POST – Spray when crop has 2 or more fully developed leaves (8–15 cm tall). • Apply before annual grasses are 5 cm high and broadleaf weeds are 15 cm high. • Carrot leaves will become yellow or light green, but they will soon regain their normal colour. • **Do NOT** apply during hot, dry weather (greater than 32°C) or when crop is under stress. • **Do NOT** apply if heavy rains are expected. • Use the lower rates for smaller weeds. • Apply GESAGARD 480 SC once per season. Apply the higher rate of GESAGARD 480 SC to muck soils.
prometryne (1.8–3.4 kg/ha) followed by linuron (0.55–1.125 L/ha)	GESAGARD 480 SC (480 g/L) followed by LOROX L (480 g/L)	3.75–7.08 L/ha (1.5–2.83 L/acre) followed by 1.1–2.25 L/ha (0.44–0.9 L/acre)	

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
CARROTS (cont'd)			
Soil Applied followed by Postemergence Grass and Broadleaf Herbicides (cont'd)			
linuron (0.55–1.125 kg/ha) followed by linuron (1.125–2.25 kg/ha)	LOROX DF (50 DF) followed by LOROX DF (50 DF)	1.1–2.25 kg/ha (0.44–0.9 kg/acre) followed by 2.25–4.5 kg/ha (0.9–1.8 kg/acre)	· PRE followed by POST. · **Do NOT** apply the 2nd treatment closer than 2 weeks after the first treatment. · **Do NOT** apply more than 2 applications per season. · Spray POST when crop has 2 or more fully developed leaves (8–15 cm tall). · Apply POST before annual grasses are 5 cm high and before broadleaf weeds are 15 cm high. · Carrot leaves will become yellow or light green, but they soon recover. · Use nozzle pressure of 175–275 kPa. **Do NOT** exceed 275 kPa. · **Do NOT** apply during hot, dry weather (greater than 32°C) or when crop is under stress. · **Do NOT** apply if heavy rains are expected. · Use the lower rates on sandy soils and for smaller weeds. · **Do NOT** use on coarse-textured soils low in organic matter.
linuron (0.55–1.125 kg/ha) followed by linuron (1.125–2.25 kg/ha)	LOROX DF (50 DF) followed by LOROX L (480 g/L)	1.1–2.25 kg/ha (0.44–0.9 kg/acre) followed by 2.25–4.5 L/ha (0.9–1.8 L/acre)	
linuron (0.55–1.125 kg/ha) followed by linuron (1.125–2.25 kg/ha)	LOROX L (480 g/L) followed by LOROX DF (50 DF)	1.1–2.25 L/ha (0.44–0.9 L/acre) followed by 2.25–4.5 kg/ha (0.9–1.8 kg/acre)	
linuron (0.55–1.125 L/ha) followed by linuron (1.125–2.25 L/ha)	LOROX L (480 g/L) followed by LOROX L (480 g/L)	1.1–2.25 L/ha (0.44–0.9 L/acre) followed by 2.25–4.5 L/ha (0.9–1.8 L/acre)	
linuron (1.125 L/ha) followed by metribuzin 0.143 kg/ha	LOROX (480 g/L) SENCOR 75 DF (75%)	2.25 L/ha (0.9 L/acre) followed by 0.19 kg/ha (0.077 kg/acre)	· To be used only on carrots previously treated with a PRE application of linuron. · **Do NOT** tank-mix with liquid fertilizers, oils, oil concentrates, or surfactants when applying postemergence because severe crop injury may occur. · **Do NOT** harvest within 60 days of postemergence application unless otherwise indicated. · On sunny days application should be made in the afternoon or early evening. · **Do NOT** apply on coarse soils with less than 2% organic matter.
Soil Applied Broadleaf Herbicides			
prometryne (1.8–3.4 kg/ha)	GESAGARD 480 SC (480 g/L)	3.75–7.08 L/ha (1.5–2.83 L/acre)	· PRE – Apply soon after seeding. · Apply in 200–1,000 L/ha (80–400 L/acre) water. · Use the lower rate on sandy soils and the higher rate on muck soils. · **Do NOT** use at or near the time of emergence. · **Do NOT** apply as a POST treatment.
linuron (0.55–1.625 kg/ha)	LOROX DF (50 DF)	1.1–3.25 kg/ha (0.44–1.3 kg/acre)	· PRE – Apply as a band or broadcast spray after planting but before carrots emerge. · Apply in 200–350 L/ha (80–140 L/acre) water. · Use the lower rate on sandy soils. · Carrots are very sensitive to this treatment at the time of emergence and severe injury can occur at this time if there is a heavy rain or if the area is irrigated.
linuron (0.55–1.625 L/ha)	LOROX L (480 g/L)	1.1–3.25 L/ha (0.44–1.3 L/acre)	

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
CARROTS (cont'd)			
Soil Applied Grass and Broadleaf Herbicides			
pendimethalin (1.68–3 kg/ha)	PROWL H20 (455g/L)	3.7–6.6 L/ha (1.5–2.67 L/acre)	• Apply 2 days after planting and before carrots and weeds have emerged. • Apply 3.7 L/ha (1.5 L/acre) for use on mineral soil and 6.6 L/ha (2.67 L/acre) for use on muck soil. • Destroy existing weeds prior to application. • **Do Not** apply PROWL H20 with liquid fertilizers. • Apply in a minimum of 200 L/ha (80 L/acre) water. • One application per year. • Best results occur when rainfall or irrigation is received within 7 days after application. • **Do Not** apply within 90 days of harvest.
s-metolachlor/benoxacor (1.098–1.601 kg/ha	DUAL II MAGNUM (915 g/L)	1.2–1.75 L/ha (0.48–0.6 L/acre)	• PRE, after planting, prior to crop and weed emergence. • Use rate Mineral Soils – 1.2–1.5 L/ha (0.48–0.6 L/acre). • Use rate Muck Soils (>20% organic matter) – 1.5–1.75 L/ha (0.6–0.7 L/acre). • Apply as a ground application ONLY. • Use ONLY 1 application per year. **Do Not** follow a PRE application with a POST spray later in the season. • Apply in 150–300 L/ha (60–120 L/acre) water. • Reduced levels of weed control may be observed when weed densities are high. • **Do NOT** harvest for 30 days after application. • **NOTE: level and duration of weed suppression may be reduced in muck soils with higher organic matter content.** • **NOTE: applications may cause significant injury to carrots, resulting in reduced yields.**
trifluralin (0.576–1.15 kg/ha)	TREFLAN EC (480 g/L)	1.2–2.4 L/ha (0.48–0.96 L/acre)	• PPI – Apply the higher rate to heavy clay soils. • **Do NOT** apply to soils with more than 15% organic matter.
	RIVAL EC (500 g/L)	1.2–2.3 L/ha (0.48–0.92 L/acre)	
	BONANZA 480 (480 g/L)	1.25–2.3 L/ha (0.5–0.92 L/acre)	
Postemergent Broadleaf Herbicides			
carfentrazone-ethyl (8.8–28.1 g/ha) + non-ionic surfactant (0.25% v/v)	AIM EC (240 g/L) + AGRAL 90	36.5–117 mL/ha (14.6–46.8 mL/acre) + 2.5 L/1,000 L	• Apply POST with a hooded sprayer between the rows. • Apply to actively growing weeds up to 10 cm tall. • Apply in a minimum of 100 L/ha (40 L/acre) water. • **Do NOT** apply closer than 1 day to harvest. • Apply **ONLY** once per growing season.
	AIM EC (240 g/L) + AG-SURF	36.5–117 mL/ha (14.6–46.8 mL/acre) + 2.5 L/1,000 L	
carfentrazone-ethyl (8.8–28.1 g/ha) + surfactant/solvent (0.1% v/v)	AIM EC (240 g/L) + MERGE	36.5–117 mL/ha (14.6–46.8 mL/acre) + 1 L/1,000 L	

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
CARROTS (cont'd)			
Postemergence Grass Herbicides			
clethodim (46–91 g/ha) + surfactant (0.5–1% v/v)	CENTURION (240 g/L) + AMIGO SELECT (240 g/L) + AMIGO	0.19–0.38 L/ha (0.08–0.15 L/acre) 5–10 L/1,000 L	· For the control of annual grasses and quackgrass. · See label for detailed information on rates to control all annual grasses. · Apply using ground equipment. · Apply in a minimum of 110 L/ha (44 L/acre) water for SELECT and 200 L/ha (80 L/acre) water for CENTURION. · Apply when grassy weeds are at 2–6 leaf stage. · **Do NOT** exceed 2 applications per year and 0.38 L/ha (0.15 L/acre). · **Do NOT** apply within 30 days of harvest.
fenoxaprop-p-ethyl (0.054 kg/ha)	EXCEL SUPER (80.5 g/L)	0.67 L/ha (0.27 L/acre)	· Apply when majority of annual grasses are in the 1–6 leaf stage or until volunteer corn is up to 25 cm tall. · Grasses emerging after application will not be controlled. · **Do NOT** apply if rain is expected within 1 h after application. · Preharvest interval is 38 days.
sethoxydim (0.15–0.5 kg/ha) + surfactant/solvent (0.25–2 L/ha)	POAST ULTRA (450 g/L) + MERGE	0.32–1.1 L/ha (0.13–0.44 L/acre) + 0.25–2 L/ha (0.1–0.8 L/acre)	· For annual grass, use 0.32 L/ha. (0.13 L/acre) Apply at the 1–6 leaf stage (2–5 is optimum). · For volunteer grains, use 0.47 L/ha. (0.19 L/acre) Apply at the 1–6 leaf stage (2–5 is optimum). · For quackgrass, use 1.1 L/ha. Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days in wide row crops. Use the high rate of MERGE for quackgrass. · Grasses emerging after application will not be controlled. · Use 100–200 L/ha (40–80 L/acre) water. · Spray tips angled forward 45° will give better coverage. · **Do NOT** use flood jet or hollow cone nozzles. · **Do NOT** apply if rain is expected within 1 h after application. · Preharvest interval is 49 days.
fluazifop-p-butyl (0.075–0.25 kg/ha)	VENTURE L (125 g/L)	0.6–2 L/ha (0.24–0.8 L/acre)	· Apply when the crop is 10 cm in height (2–5 leaf stage) or less. · Apply at 0.6 L/ha (0.24 L/acre) at 2–5 leaf stage of volunteer corn. · Apply at 0.8 L/ha (0.32 L/acre) at 2–5 leaf stage of volunteer wheat and barley. · Apply at 1 L/ha (0.4 L/acre) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails). · Apply at 2 L/ha (0.8 L/acre) at 3–5 leaf stage of quackgrass and wirestem muhly. · Thorough preplant tillage, fragmenting quackgrass rhizomes improves control. · **Do NOT** cultivate between rows until 5 days after application. · Apply other postemergence herbicides separately at least 3 days after VENTURE L. · **Do NOT** harvest for 50 days after application.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
CARROTS (cont'd)			
Postemergence Grass and Broadleaf Herbicides			
s-metolachlor/ benoxacor (1.098–1.373 kg/ha)	DUAL II MAGNUM (915 g/L)	1.2–1.5 L/ha (0.48–0.6 L/acre)	· Apply during the crop's 3–5 leaf stage and before the weed's 2 leaf stage. · Apply as a ground application **ONLY.** · Use **ONLY** 1 application per year. · Apply in 150–300 L/ha (60–120 L/acre) water. · Reduced levels of weed control may be observed when weed densities are high. · **Do NOT** harvest for 30 days after application. · **NOTE: level and duration of weed suppression may be reduced in muck soils with higher organic matter content.** · **NOTE: applications may cause significant injury to carrots, resulting in reduced yields.**
linuron (1.125–2.25 kg/ha)	LOROX DF (50 DF)	2.25–4.5 kg/ha (0.9–1.8 kg/acre)	· For carrots not treated with linuron PRE. · Spray when the crop has 2 or more fully developed leaves (8–15 cm tall). · Apply before annual grasses are 5 cm high and before broadleaf weeds are 15 cm high. · Carrot leaves will become yellow or light green, but they will soon regain their normal colour. · Use nozzle pressure of 175–275 kPa. **Do NOT** exceed 275 kPa. · **Do NOT** apply with herbicidal oil. · **Do NOT** apply during hot, dry weather (greater than 32°C) or when the crop is under stress.
linuron (1.125–2.25 L/ha)	LOROX L (480 g/L)	2.25–4.5 L/ha (0.9–1.8 L/acre)	
pendimethalin (1.68–3 kg/ha)	PROWL H20 (455g/L)	3.7–6.6 L/ha (1.5–2.67 L/acre)	· Apply 2 days after planting and before carrots and weeds have emerged. · Apply 3.7 L/ha for use on mineral soil and 6.6 L/ha for use on muck soil. · Destroy existing weeds prior to application. · **Do NOT** apply PROWL H20 with liquid fertilizers. · Apply in a minimum of 200 L/ha (80 L/acre) of water. · One application per year. · Best results occur when rainfall or irrigation is received within 7 days after application. · **Do NOT** apply within 90 days of harvest.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
CELERY			
Site Preparation Before Planting – See Chapter 6, Preplant & Postharvest Weed Control, page 91.			
Soil Applied Grass and Broadleaf Herbicides			
flumioxazin (71.5–107.3 g/ha)	CHATEAU WDG (51.1%).	140–210 g/ha (56.7–85 g/acre)	· Apply as a hooded or shielded spray to row middles prior to transplanting celery for pre-emergence control of weeds. · Rainfall or irrigation must occur between application and transplanting in order to activate the product. · **Do NOT** apply more than 210 g/ha (85 g/acre) per season. · Plants should be grown on raised or plastic mulched beds that are at least 10 cm higher than the treated row middle and the mulched bed must have a minimum of 60 cm bed width.
Postemergence Broadleaf Herbicides			
carfentrazone-ethyl (8.8–28.1 g/ha) + non-ionic surfactant (0.25% v/v)	AIM EC (240 g/L) + AGRAL 90	36.5–117 mL/ha (14.6–46.8 mL/acre) + 2.5 L/1,000 L	· Apply POST with a hooded sprayer between the rows. · Apply to actively growing weeds up to 10 cm tall. · Apply in a minimum of 100 L/ha (40 L/acre) water. · **Do NOT** apply closer than 1 day to harvest. · Apply **ONLY** once per growing season.
	AIM EC (240 g/L) + AG-SURF		
carfentrazone-ethyl (8.8–28.1 g/ha) + surfactant/solvent (0.1% v/v)	AIM EC (240 g/L) + MERGE	36.5–117 mL/ha (14.6–46.8 mL/acre) + 1 L/1,000 L	
Postemergence Grass Herbicides			
sethoxydim (0.15–0.50 kg/ha) + surfactant/solvent (0.25–2 L/ha)	POAST ULTRA (450 g/L) + MERGE	0.32–1.1 L/ha (0.13–0.44 L/acre) + 0.5–2 L/ha (0.1–0.8 L/acre)	· Use **ONLY** 1 application per year. · For annual grass, use 0.32 L/ha (0.13 L/acre). Apply at the 1–6 leaf stage (2–5 is optimum). · For volunteer grains, use 0.47 L/ha (0.19 L/acre). Apply at the 1–6 leaf stage (2–5 is optimum). · For quackgrass, use 1.1 L/ha (0.44 L/acre). Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days in wide row crops. Use the high rate of MERGE for quackgrass. · Grasses emerging after application will not be controlled. · Use 100–200 L/ha (40–80 L/acre) water at 200 kPa. · Preharvest interval is 30 days.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
CELERY (cont'd)			
Postemergence Grass and Broadleaf Herbicides			
prometryne (1.8–2.2 kg/ha)	GESAGARD 480 SC (480 g/L)	3.75–4.58 L/ha (1.5–1.83 L/acre)	· **Do NOT** apply until 21 days after transplanting the crop when the celery plants are established. · Apply in 200–1,000 L/ha (80–400 L/acre) water in the transplanted crop. · **Do NOT** use on direct seeded crop. · Apply before weeds reach 5 cm tall. · Apply **ONLY** once a season. · Preharvest interval is 54 days.
linuron (0.91–2.26 kg/ha)	LOROX DF (50 DF)	1.82–4.51 kg/ha (0.73–1.8 kg/acre)	· Apply to transplants as soon as new growth has started. Some temporary discolouration may occur. · All dosages are expressed as broadcast rates. For band treatment use proportionately less. · **Do NOT** use on sandy or coarse-textured soils low in organic matter (less than 1%), as crop injury may result.
linuron (0.91–2.26 L/ha)	LOROX L (480 g/L)	1.82–4.51 L/ha (0.73–1.8 L/acre)	
CELERIAC, TRANSPLANTED			
Postemergence Grass and Broadleaf Herbicides			
prometryne (1.8–2.2 kg/ha)	GESAGARD 480 SC (480 g/L)	3.75–4.58 L/ha (1.44–1.85 L/acre)	· Apply after the celeriac transplants are well established (21 days). · Treatment may be pre or early post to the weeds, but before the weeds are 5 cm high. · **ONLY** one application per season. · **Do NOT** harvest within 54 days of application.
ROOT CHICORY			
Postemergence Broadleaf Herbicides			
carfentrazone-ethyl (8.8–28.1 g/ha) + non-ionic surfactant (0.25% v/v)	AIM EC (240 g/L) + AGRAL 90	36.5–117 mL/ha (14.6–46.8 mL/acre) + 2.5 L/1,000 L	· Apply POST with a hooded sprayer between the rows. · Apply to actively growing weeds up to 10 cm tall. · Apply in a minimum of 100 L/ha (40 L/acre) water. · **Do NOT** apply closer than 1 day to harvest. · Apply **ONLY** once per growing season.
	AIM EC (240 g/L) + AG-SURF	36.5–117 mL/ha (14.6–46.8 mL/acre) + 2.5 L/1,000 L	
carfentrazone-ethyl (8.8–28.1 g/ha) + surfactant/solvent (0.1% v/v)	AIM EC (240 g/L) + MERGE	36.5–117 mL/ha (14.6–46.8 mL/acre) + 1 L/1,000 L	
triflusulfuron-methyl (17.5–35 g/ha) + non-ionic surfactant (0.25% v/v)	UPBEET (50 DF) + AGRAL 90	35–70 g/ha (14–28 g/acre) + 2.5 L/1,000 L	· For the control of velvetleaf. · Apply POST after emergence of chicory and velvetleaf, but prior to the 4 leaf stage of velvetleaf. · Apply in 100–300 L/ha (60–120 L/acre) water. · **Do NOT** exceed 70 g/ha (28 g/acre) per season. · If the lower rate has been used and velvetleaf continues to emerge, repeat application in 2–3 weeks. · **Do NOT** harvest within 60 days of treatment. · Temporary yellowing of the crop may occur.
	UPBEET (50 DF) + AG-SURF		
	UPBEET (50 DF) + CITOWETT PLUS		

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
ROOT CHICORY (cont'd)			
Postemergence Grass Herbicides			
sethoxydim (0.15–0.5 kg/ha) + surfactant/solvent (0.25–2 L/ha)	POAST ULTRA (450 g/L) + MERGE	0.32–1.1 L/ha (0.13–0.45 L/acre) + 0.25–2 L/ha (0.1–0.8 L/acre)	· Apply to actively growing grasses. · For annual grass, use 0.32 L/ha (0.13 L/acre). Apply at the 2–6 leaf stage. · For volunteer grass, apply at a rate of 0.47 L/ha (0.19 L/acre). · For quackgrass, use 1.1 L/ha (0.44 L/acre). Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days in wide row crops. · Use the high rate of MERGE for quackgrass. · Grasses emerging after application will not be controlled. · Use 100–200 L/ha (40–80 L/acre) water. · Spray tips angled forward 45° will give better coverage. · **Do NOT** use flood jet or hollow cone nozzles. · **Do NOT** apply if rain is expected within 1 h after application. · **Do NOT** wait to spray broadleaf weeds if grassy weeds are not in the appropriate stage. · **Do NOT** apply closer than 60 days to harvest.
CUCUMBER			
Site Preparation Before Planting – See Chapter 6, Preplant & Postharvest Weed Control, page 91.			
Preplant (Stale Seedbed Technique)			
glyphosate (0.267–1.246 kg/ha)	glyphosate (360 g/L)*	0.75–3.5 L/ha (0.3–1.4 L/acre)	· Till and fertilize soil in early spring, and then allow weeds to grow. · Spray weeds just before seeding the crop. · Use low rate for small weeds (8 cm), medium rates for weeds 8–15 cm and higher rate for weeds over 15 cm tall. · Apply appropriate PRE or POST herbicides to control new flushes of weeds or use mechanical means of control. * See Table 4–1. Herbicides Used in Ontario, page 30, for formulations available. Not all formulations registered on all crops. See label for specific uses and rates.
	glyphosate (480 g/L)*	0.56–2.6 L/ha (0.23–1.05 L/acre)	
	glyphosate (500 g/L)*	0.53–2.5 L/ha (0.21–1.01 L/acre)	
	glyphosate (540 g/L)*	0.5–2.3 L/ha (0.2–0.94 L/acre)	
Soil Applied Grass Herbicides			
bensulide (5.76–6.72 kg/ha)	PREFAR (480 g/L)	12–14 L/ha (4.8–5.6 L/acre)	· PPI – For mineral soils **ONLY**. · Incorporate thoroughly into the soil to a depth of 2.5–5 cm. · Apply in 100–500 L/ha (40–200 L/acre) water, **ONLY** once a year.
Soil Applied Broadleaf Herbicides			
fomesafen (0.24 kg/ha) + adjuvant (0.1% v/v)	REFLEX (240 g/L) + AGRAL 90	1.0 L/ha (0.4 L/acre) +1.0 L/1,000 L	· PRE – banded to row middles. · **Do NOT** make more than 1 application per season. · Apply just after seeding but prior to crop emergence, or just prior to transplanting cucumber plants. · **Do NOT** apply by air. · **Do NOT** rotate to another crop in the same season. · **Do NOT** apply reflex to any field more often than once every 2 years. · Pre-Harvest Interval of 42 days.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
CUCUMBER (cont'd)			
Soil Applied Grass and Broadleaf Herbicides			
clomazone (0.28–0.42 kg/ha)	COMMAND 360 ME (360 g/L)	0.78–1.17 L/ha (0.31–0.47 L/acre)	· Apply PRE, after seeding but before crop emergence, **ONLY** once per year. **Do NOT** incorporate. · For light textured soils – Apply COMMAND at 0.78 L/ha (0.31 L/acre). **Do NOT** apply to sandy soil. · For heavy textured soils – Apply COMMAND at 1.17 L/ha (0.47 L/acre). · Some rotational cropping restrictions apply (see Table 4–4. Herbicide Crop Rotation and Soil pH Restrictions – Field Crops, page 74). · Apply in 95–375 L/ha (38–150 L/acre) water. · **Do NOT** harvest for 45 days after application.
chlorthal dimethyl (6.75–11.625 kg/ha)	DACTHAL W-75 (75 WP)	9–15.5 kg/ha (3.6–6.2 kg/acre)	· Apply only when cucumber plants have 4–5 true leaves, are well established and growing conditions are favourable for good plant growth otherwise crop injury may result. · Apply PRE prior to weed seed germination. If weeds have emerged, cultivate the soil before application. · Apply at a rate of 9–13.5 kg/ha (3.6–5.4 kg/acre) on light sand or sandy loam soils. · Apply at a rate of 11–15.5 kg/ha (4.4–6.2 kg/acre) on medium silt loam soils. · **Do NOT** use on muck soils. · Apply in at least 225 L/ha (90 L/acre) of water. · Rainfall or irrigation (about 1 cm) is necessary for activation.
s-metolachlor/ benoxacor (1.05–kg/ha)	DUAL II MAGNUM (915 g/L)	1.15 L/ha	· Apply prior to transplanting or within 48 hours after transplanting. · Apply PRE in direct seeded crops prior to weed emergence OR at the 1–2 leaf stage of the crop but still PRE to weed emergence. · Make ONLY 1 application per year. • **Do NOT** harvest within 30 days of treatment. · Reduced control in heavy weed populations may occur. · Risk of crop injury increases with cool and wet conditions. · Foliar contact can increase the potential to cause crop injury. Avoid overspray.
halosulfuron (25–51 g/ha)	(0.47 L/acre)	35–70 g/ha (14–28 g/acre)	· For use on direct seeded and transplanted cucumbers on bare soil or before installation of plastic mulch. · Apply after planting and before soil cracking on direct seeded plants. · **Do NOT** direct seed in plastic mulch or transplant sooner than 7 days after application. · Maximum of two applications per season with a minimum of 21 days between applications. Do not apply more than 140 g/ha (56 g/acre) per season. · Use a lower rate on lighter textured soils · Use a minimum water volume of 140 L/ha (56 L/acre). · Rains greater than 1 inch within 5–7 days of application may cause temporary yellowing and delay development of crop. · **Do NOT** spray over top of plastic mulch. · **Do NOT** harvest within 30 days after application.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
CUCUMBER (cont'd)			
Postemergence Broadleaf Herbicides			
carfentrazone-ethyl (8.8–28.1 g/ha) + non-ionic surfactant (0.25% v/v)	AIM EC (240 g/L) + AGRAL 90 AIM EC (240 g/L) + AG-SURF	36.5–117 mL/ha (14.6–46.8 mL/acre) + 2.5 L/1,000 L	· Apply POST with a hooded sprayer between the rows. · Apply to actively growing weeds up to 10 cm tall. · Apply in a minimum of 100 L/ha (40 L/acre) water. · **Do NOT** apply closer than 1 day to harvest. · Apply **ONLY** once per growing season.
carfentrazone-ethyl (8.8–28.1 g/ha) + surfactant/solvent (0.1% v/v)	AIM EC (240 g/L) + MERGE	36.5–117 mL/ha (14.6–46.8 mL/acre) + 1 L/1,000 L	
halosulfuron (25–51 g/ha) + non-ionic surfactant (0.2% v/v)	SANDEA (72.6 WG) + non-ionic surfactant	35–70 g/ha (14–28 g/acre) + 2.5 L/1,000 L	· Apply to direct seeded or actively growing transplanted cucumbers between 3–5 true leaf stage or 14 days after transplanting and appearance of first female flower. · Row middles can be sprayed at all crop stages. · Maximum of two applications per season with a minimum of 21 days between applications. **Do NOT** apply more than 140 g/ha (56 g/acre) per season. · Use a minimum water volume of 140 L/ha (56 L/acre). · Spraying over top of plastic mulch may result in significant injury. · **Do NOT** harvest within 30 days after application.
Postemergence Grass Herbicides			
quizalofop-p-ethyl (0.036–0.07 kg/ha) + oil concentrate (0.5% v/v)	ASSURE II (96 g/L) + MERGE ASSURE II (96 g/L) + SURE-MIX YUMA GL (96g/L) +XA OIL CONCENTRATE	0.38–0.75 L/ha (0.15–0.3 L/acre) + 5 L/1,000 L	· Make 1 application per year when the crop is at the 2–6 leaf stage. · Apply at the labelled leaf stage of grassy weeds. · Use ground equipment only. Use a minimum of 100 L/ha (40 L/acre) water. · **Do NOT** enter or allow worker entry into treated areas during the restricted entry interval of 4 days for scouting, irrigation and hand weeding activities. · **Do NOT** apply within 30 days of harvest.
sethoxydim (0.14–0.5 kg/ha) + surfactant/solvent (0.25–2 L/ha)	POAST ULTRA (450 g/L) + MERGE	0.32–1.1 L/ha (0.13–0.44 L/acre) + 0.25–2 L/ha (0.1–0.8 L/acre)	· For annual grass, use 0.32 L/ha (0.13 L/acre). Apply at the 1–6 leaf stage. · For volunteer grains, use 0.47 L/ha. · For quackgrass, use 1.1 L/ha (0.44 L/acre). Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days in wide row crops. Use the high rate of MERGE for quackgrass. · Use 100–200 L/ha (40–80 L/acre) water. · **Do NOT** use flood jet or hollow cone nozzles. · **Do NOT** apply if rain is expected within 1 h after application. · **Do NOT** wait to spray broadleaf weeds if grassy weeds are not in the appropriate stage. · **Do NOT** apply closer than 30 days to harvest.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
CUCUMBER (cont'd)			
fluazifop-p-butyl (0.075–0.25 kg/ha)	VENTURE L (125 g/L)	0.6–2 L/ha (0.24–0.8 L/acre)	· Apply POST to actively growing grasses before tillering. · Apply at 0.6 L/ha (0.24 L/acre) at 2–5 leaf stage of volunteer corn. · Apply at 0.8 L/ha (0.32 L/acre) at 2–5 leaf stage of volunteer wheat and barley. · Apply at 1 L/ha (0.4 L/acre) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails). · Apply at 2 L/ha (0.8 L/acre) at 3–5 leaf stage of quackgrass and wirestem muhly. · Thorough fragmentation of quackgrass rhizomes by pre-application tillage will improve control. · **Do NOT** cultivate between rows until 5 days after application. · **Do NOT** harvest for 30 days after application. · **ONLY** make 1 application per season.
GARLIC			
Site Preparation Before Planting – See Chapter 6, Preplant & Postharvest Weed Control, page 91.			
Soil Applied Grass and Broadleaf Herbicides			
chlorthal dimethyl (6.75–13.5 kg/ha)	DACTHAL W-75 (75 WP)	9–18 kg/ha (3.6–7.2 kg/acre)	· PRE – Apply immediately after seeding or directly over transplants, preemergence to weeds. · Apply at a rate of 9–13.5 kg/ha (3.6–5.4 kg/acre) on light sand or sandy loam soils. · Apply at a rate of 11–15.5 kg/ha (4.4–6.2 kg/acre) on medium silt loam soils. · Apply at a rate of 18 kg/ha (7.2 kg/acre) on heavy clay soils. · **Do NOT** use on muck soils. · Apply in at least 225 L/ha (90 L/acre) of water. · If weeds have emerged, cultivate the soil before application. · Rainfall or irrigation (about 1 cm) is necessary for activation.
napropamide (1.12–2.25 kg/ha)	DEVRINOL DF (50 DF) DEVRINOL DF-XT (50 DF-XT)	2.24–4.5 kg/ha (0.9–1.8 kg/acre)	· PRE – 1 application per year only, prior to crop and weed emergence. · Apply in 200–900 L/ha (80–360 L/acre) water. · Use the lower rate on light soils (coarse textured to sandy and sandy loam). · **Do NOT** apply closer than 60 days to harvest. · Damage to subsequent crops and cover crops can be reduced by tillage across the rows after harvest. Small grains seeded in the fall may be stunted but not otherwise affected.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
GARLIC (cont'd)			
Postemergence Grass Herbicides			
sethoxydim (0.14–0.5 kg/ha) + surfactant/solvent (0.25–2 L/ha)	POAST ULTRA (450 g/L) + MERGE	0.32–1.1 L/ha (0.13–0.44 L/acre) + 0.25–2 L/ha (0.1–0.8 L/acre)	· For annual grass, use 0.32 L/ha (0.13 L/acre). Apply at the 1–6 leaf stage. · For volunteer grains, use 0.47 L/ha (0.19 L/acre). · For quackgrass, use 1.1 L/ha (0.44 L/acre). Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days in wide row crops. Use the high rate of MERGE for quackgrass. · Use 100–200 L/ha (40–80 L/acre) water. · **Do NOT** use flood jet or hollow cone nozzles. · **Do NOT** apply if rain is expected within 1 h after application. · **Do NOT** wait to spray broadleaf weeds if grassy weeds are not in the appropriate stage. · **Do NOT** apply closer than 50 days to harvest.
Postemergence Broadleaf Herbicides			
carfentrazone-ethyl (8.8–28.1 g/ha) + non-ionic surfactant (0.25% v/v)	AIM EC (240 g/L) + AGRAL 90	36.5–117 mL/ha (14.6–46.8 mL/acre) 2.5 L/1,000 L	· Apply POST with a hooded sprayer between the rows. · Apply to actively growing weeds up to 10 cm tall. · Apply in a minimum of 100 L/ha (40 L/acre) water. · **Do NOT** apply closer than 1 day to harvest. · Apply **ONLY** once per growing season.
	AIM EC (240 g/L) + AG-SURF		
carfentrazone-ethyl (8.8–28.1 g/ha) + surfactant/solvent (0.1% v/v)	AIM EC (240 g/L) + MERGE	36.5–117 mL/ha (14.6–46.8 mL/acre) + 1 L/1,000 L	
bromoxynil (0.28 kg/ha)	PARDNER (280 g/L)	1 L/ha (0.4 L/acre)	· Apply to actively growing broadleaf weeds at the 1–4 leaf stage. · Apply in 200–300 L/ha (80–100 L/acre) water. · Apply at 275 kPa. · Use **ONLY** 1 ground application per year. · **Do NOT** use flood jet nozzles. · **Do NOT** spray at temperatures above 25°C. · **Do NOT** apply closer than 58 days to harvest.
bromoxynil (0.29 kg/ha)	BROTEX (240 g/L)	1.2 L/ha (0.48 L/acre)	
	BROMOTRIL (240 g/L)		

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
GINSENG			
Site Preparation Before Planting – See Chapter 6, Preplant & Postharvest Weed Control, page 91.			
Preplant or Prior to Crop Emergence (Stale Seedbed Technique)			
glyphosate (0.75–0.9 kg/ha)	glyphosate (360 g/L)*	2.1–2.5 L/ha (0.85–1 L/acre)	· Apply POST to weeds once in the spring but before the crop has emerged above the soil. · Apply in 50–100 L/ha (20–40 L/acre) water. · **Do NOT** exceed rate or spray volume as crop injury may result. · **Do NOT** contact actively growing ginseng foliage. · **Do NOT** use a fall application in existing/established gardens. * See Table 4–1. Herbicides Used in Ontario, page 30, for formulations available. Not all formulations registered on all crops. See label for specific uses and rates.
	glyphosate (480 g/L)*	1.56–1.88 L/ha (0.63–0.76 L/acre))	
	glyphosate (500 g/L)*	1.5–1.8 L/ha (0.61–0.73 L/acre)	
	glyphosate (540 g/L)*	1.39–1.67 L/ha (0.56–0.68 L/acre)	
Postemergence Grass Herbicides			
fluazifop-p-butyl (0.075–0.25 kg/ha)	VENTURE L (125 g/L)	0.6–2 L/ha (0.24–0.8 L/acre)	· Apply POST up to 3 times/year: early May, late June and/or mid-August. · Apply to actively growing grasses prior to tillering. · **Do NOT** apply in the year of harvest. · Apply through ground application only.
Postemergence Broadleaf Herbicides			
carfentrazone-ethyl (8.8–28.1 g/ha) + non-ionic surfactant (0.25% v/v)	AIM EC (240 g/L) + AGRAL 90	36.5–117 mL/ha (14.6–46.8 mL/acre) + 2.5 L/1,000 L	· Apply POST with a hooded sprayer between the rows. · Apply to actively growing weeds up to 10 cm tall. · Apply in a minimum of 100 L/ha (40 L/acre) water. · **Do NOT** apply closer than 1 day to harvest. · Apply **ONLY** once per growing season.
	AIM EC (240 g/L) + AG-SURF		
carfentrazone-ethyl (8.8–28.1 g/ha) + surfactant/solvent (0.1% v/v)	AIM EC (240 g/L) + MERGE	36.5–117 mL/ha (14.6–46.8 mL/acre) + 1 L/1,000 L	
HERBS			
Site Preparation Before Planting – See Chapter 6, Preplant & Postharvest Weed Control, page 91.			
Soil Applied Grass and Broadleaf Herbicides			
flumioxazin (0.14 kg/ha)	CHATEAU WDG (51.1%)	0.28 kg/ha (0.113 kg/acre)	· Apply **ONLY** to peppermint and spearmint. · Apply **ONLY** once per season. · Apply **ONLY** to established, dormant mint for pre-emergent control of weeds. Application to non-dormant mint may result in unacceptable crop injury. · **Do NOT** apply within 80 days of harvest.
napropamide (1.1–2.2 kg/ha)	DEVRINOL DF (50 DF)	2.2–4.4 kg/ha (0.88–1.76 kg/acre)	· PRE or PPI – Use on basil **ONLY.** · Apply in 200–900 L/ha (80–360 L/acre) water. · **ONLY** 1 application per year. · **Do NOT** plant non-labeled crops until 12 months after application to avoid injury. · High rates may result in temporary crop stunting or retardation. However, crops will outgrow the injury and yield is unaffected.
	DEVRINOL DF-XT (50 DF-XT)		

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
HERBS (cont'd)			
Soil Applied Grass and Broadleaf Herbicides (cont'd)			
linuron (0.65–1.25 kg/ha)	LOROX DF (50 DF)	1.3–2.5 kg/ha (0.52–1.0 kg/acre)	· Use on Dill **ONLY**. · Plant seed at least 1.3 cm deep · PRE apply as a band or broadcast application after planting, at a rate of 1.3–1.9 L/ha (0.5–0.8 L/acre) on loam or clay soil with low organic matter, or at a rate of 1.9–2.5 L/ha (0.8–1 L/acre) on muck or clay soil with medium organic matter.
linuron (0.65–1.25 L/ha)	LOROX L (480 g/L)	1.3–2.5 L/ha (0.52–1.0 L/acre)	
	AFOLAN (450 g/L)		
terbacil (1.4 kg/ha)	SINBAR (80 WP)	1.75 kg/ha (0.7 kg/acre)	· PRE – Use on peppermint and spearmint **ONLY**. · Apply once per crop season at the end of September to early October. · **Do NOT** apply closer than 9 or 10 months to harvest. · **Do NOT** use on soils with less than 1% organic matter.
	SINBAR (80 WDG)		
Postemergence Grass Herbicides			
sethoxydim (0.14–0.29 kg/ha) + surfactant/solvent (0.25–2 L/ha)	POAST ULTRA (450 g/L) + MERGE	0.32–0.65 L/ha (0.13–0.26 L/acre) + 0.25–2 L/ha (0.1–0.8 L/acre)	· Use on borage, spearmint and peppermint **ONLY**. · Use the minimum application rate for borage **ONLY**. · For annual grass, use 0.32 L/ha (0.13 L/acre). Apply at the 1–6 leaf stage. · For volunteer grains, use 0.47 L/ha (0.19 L/acre). · For quackgrass suppression, use 0.65 L/ha (0.26 L/acre). Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days in wide row crops. Use the high rate of MERGE for quackgrass. · Apply using 100–200 L/ha (40 –80 L/acre) water. · **Do NOT** harvest borage within 70 days of application.
clethodim (0.03–0.091 kg/ha) + surfactant (0.5%–1% v/v)	SELECT (240g/L) + AMIGO	0.125–0.38 L/ha (0.05–0.152 L/acre) + 5–10 L/1,000 L	· For use on coriander, caraway and basil **ONLY**. · Apply using ground equipment. · Apply to weeds in the 2–6 leaf stage and when coriander is in the 2–5 leaf stage · **Do NOT** exceed 1 application per year. · **Do NOT** use treated leaves and greens of coriander and caraway for human consumption. · **Do NOT** harvest for 60 days after application.
	CENTURION (240 g/L) + AMIGO		
Soil Applied followed by Postemergence Grass and Broadleaf Herbicides			
linuron (0.65–1.25 kg/ha)	LOROX DF (50 DF)	1.3–2.5 kg/ha (0.52–1.0 kg/acre)	· Use on Dill **ONLY**. · Apply a maximum of 1.9 L/ha (0.8 L/acre) pre-emergence followed by a maximum of 2.5 L/ha (1 L/acre) post emergence. · These treatments must be at LEAST 2 weeks apart or crop injury may result. NEVER apply more than these two applications per season and do not use higher rates. · Observe instructions for both pre-emergence and post-emergence use carefully before using. · **Do NOT** apply within 60 days of harvest.
linuron (0.65–1.25 L/ha)	LOROX L (480 g/L)	1.3–2.5 L/ha (0.52–1.0 L/acre)	
	AFOLAN (450 g/L)		

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
HERBS (cont'd)			
Postemergence Grass and Broadleaf Herbicides			
linuron (0.95–2.35 kg/ha)	LOROX DF (50 DF)	1.9–4.7 kg/ha (0.77–1.9 kg/acre)	· Use on Dill **ONLY**. · Apply when crop has 2 or more fully developed leaves. Use lower rates on small seedling weeds and the higher rates on established weeds. · Apply LOROX in a water volume of 220–440 L/ha (88–160 L/acre). · Apply before annual grasses exceed 5 cm in height and before broadleaf weeds exceed 15 cm. During hot, dry weather, spray in cool part of the day to avoid injury. · Nozzle pressure must not exceed 275 kPa as crop injury may result. · **Do NOT** apply within 60 days of harvest.
linuron (0.95–2.35 L/ha)	LOROX L (480 g/L)	1.9–4.7 L/ha (0.77–1.9 L/acre)	
	AFOLAN (450 g/L)		
LEEKS			
Site Preparation Before Planting – See Chapter 6, Preplant & Postharvest Weed Control, page 91.			
Postemergence Broadleaf Herbicides			
carfentrazone-ethyl (8.8–28.1 g/ha) + non-ionic surfactant (0.25% v/v)	AIM EC (240 g/L) + AGRAL 90	36.5–117 mL/ha (14.6–46.8 mL/acre) + 2.5 L/1,000 L	· Apply POST with a hooded sprayer between the rows. · Apply to actively growing weeds up to 10 cm tall. · Apply in a minimum of 100 L/ha (40 L/acre) water. · **Do NOT** apply closer than 1 day to harvest. · Apply **ONLY** once per growing season.
	AIM EC (240 g/L) + AG-SURF		
carfentrazone-ethyl (8.8–28.1 g/ha) + surfactant/solvent (0.1% v/v)	AIM EC (240 g/L) + MERGE	36.5–117 mL/ha (14.6–46.8 mL/acre) + 1 L/1,000 L	
Postemergence Grass and Broadleaf Herbicides			
prometryne (1.8 kg/ha)	GESAGARD 480 SC (480 g/L)	3.75 L/ha (1.5 L/acre)	· Apply 2 applications 10 days apart, before weeds are 5 cm high. · Make the first application to well-established transplanted leeks that have produced 1 new fully expanded leaf. · Can be used on either muck or mineral soils. · **Do NOT** use more than 2 applications a year. · Temporary injury can occur to the lower leaves in some cultivars of leek.
pendimethalin (1.08 kg/ha)	PROWL H20 (455 g/L)	2.37 L/ha (0.95 L/acre)	· Use on Mineral soil **ONLY**. · Apply as a single application at the 2 to 3 leaf stage of green onions or after transplanting leeks, before weed emergence. · Destroy existing weeds prior to application. · **Do NOT** apply PROWL H20 with liquid fertilizers. · Apply in a minimum of 200 L/ha (80 L/acre) water. · Best results occur when rainfall or irrigation is received within 7 days after application. · **Do NOT** apply within 30 days of harvest.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
LETTUCE			
Site Preparation Before Planting – See Chapter 6, Preplant & Postharvest Weed Control, page 91.			
Soil Applied Grass and Broadleaf Herbicides			
propyzamide (1.1 kg/ha)	KERB (50 WSP)	2.2 kg/ha (0.88 kg/acre)	· Apply PPI, PRE or POST to direct seeded lettuce or 7 to 10 days after transplanting. · All applications must be made to weed free soil. · Use only once per year. · **Do NOT** replant lettuce in KERB treated fields in the same year. · **Do NOT** use on muck soils. · **Do NOT** apply closer than 55 days to harvest.
Postemergence Broadleaf Herbicides			
carfentrazone-ethyl (8.8–28.1 g/ha) + non-ionic surfactant (0.25% v/v)	AIM EC (240 g/L) + AGRAL 90	36.5–117 mL/ha (14.6–46.8 mL/acre) + 2.5 L/1,000 L	· Apply POST with a hooded sprayer between the rows. · Apply to actively growing weeds up to 10 cm tall. · Apply in a minimum of 100 L/ha (40 L/acre) water. · **Do NOT** apply closer than 1 day to harvest. · Apply only once per growing season.
	AIM EC (240 g/L) + AG-SURF		
carfentrazone-ethyl (8.8–28.1 g/ha) + surfactant/solvent (0.1% v/v)	AIM EC (240 g/L) + MERGE	36.5–117 mL/ha (14.6–46.8 mL/acre) + 1 L/1,000 L	
Postemergence Grass Herbicides			
sethoxydim (0.14–0.5 kg/ha) + surfactant/solvent (0.25–2 L/ha)	POAST ULTRA (450 g/L) + MERGE	0.32–1.1 L/ha (0.13–0.44 L/acre) + 0.25–2 L/ha (0.1–0.8 L/acre)	· For annual grass, use 0.32 L/ha (0.13 L/acre). Apply at the 1–6 leaf stage (2–5 is optimum). · For volunteer grains, use 0.47 L/ha (0.19 L/acre). Apply at the 1–6 leaf stage (2–5 is optimum). · For quackgrass, use 1.1 L/ha (0.44 L/acre). Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days in wide row crops. Use the high rate of MERGE for quackgrass. · Grasses emerging after application will not be controlled. · Use 100–200 L/ha (40–80 L/acre) water. · Spray tips angled forward 45° will give better coverage. · For transplanted lettuce, apply once a year during the 1–6 leaf stage. · For direct seeded lettuce, two applications can be made. · First application between 1–6 leaf stage and the second application 14–21 days after thinning. · **Do NOT** exceed an application rate of 1.1 L/ha (0.44 L/acre) with direct seeded lettuce. · **Do NOT** use flood jet or hollow cone nozzles. · **Do NOT** apply if rain is expected within 1 h after application. · Preharvest interval is 30 days.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
MUSKMELON, WATERMELON, SQUASH AND PUMPKIN			
Site Preparation Before Planting – See Chapter 6, Preplant & Postharvest Weed Control, page 91.			
Soil Applied Broadleaf Herbicide			
halosulfuron (25–51 g/ha)	SANDEA (72.6 WG)	35–70 g/ha (14–28 g/acre)	· For use on direct seeded and transplanted plants on bare soil. · Apply after planting and before soil cracking on direct seeded plants. · For use on muskmelon and watermelon before installation of plastic mulch. · **Do NOT** direct seed in plastic mulch or transplant sooner than 7 days after application. · Apply at a rate of 35–70 g/ha (14–28 g/acre) on muskmelon, direct seeded processing pumpkins and winter squash; 35–52.5 g/ha (14–21 g/acre) on watermelon, fresh market pumpkins and winter squash; and 47–70 g/ha (19–28 g/acre) on direct seeded processing summer squash. · Maximum of two applications per season with a minimum of 21 days between applications. · **Do NOT** apply more than 70 g/ha (28 g/acre) per season on watermelon, pumpkins and winter squash and 140 g/ha (56 g/acre) on muskmelon and summer squash. · Use a lower rate on lighter textured soils. · Use a minimum water volume of 140 L/ha (56 g/acre) for muskmelons, pumpkins and winter squash and 190 L/ha (76 L/acre) for watermelon and processing summer squash. · Rains greater than 1 in. within 5–7 days of application may cause temporary yellowing and delay development of crop. · **Do NOT** spray over top of plastic mulch. · **Do NOT** harvest within 57 days after application for muskmelon and watermelon and 30 days for pumpkins and squash.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
MUSKMELON, WATERMELON, SQUASH AND PUMPKIN (cont'd)			
Soil Applied Grass and Broadleaf Herbicides			
clomazone (0.28–0.42 kg/ha)	COMMAND 360 ME (360 g/L)	0.78–1.17 L/ha (0.31–0.47 L/acre)	· Apply PRE, once per season. **Do NOT** incorporate. Apply after seeding but before emergence. · Apply the lower rate for melons. · Apply broadcast at 0.78 L/ha (0.31 L/acre) to squash and pumpkins on light soils. · Apply broadcast at 1.17 L/ha (0.47 L/acre) to squash and pumpkins on heavy soils. · Some rotational cropping restrictions apply (see Table 4–4. Herbicide Crop Rotation and Soil pH Restrictions: Field Crops, page 74). · **Do NOT** harvest melons for 60 days after application. · **Do NOT** harvest squash and processing pumpkins for 45 days after application. · **Do NOT** apply to Jack-O-Lantern pumpkins. · **Do NOT** apply to sandy soil. · Consult the product label for varieties sensitive to colouration after application.
chlorthal dimethyl (6.75–11.625 kg/ha)	DACTHAL W-75 (75 WP)	9–15.5 kg/ha (3.6–6.2 kg/acre)	· PRE – apply prior to weed seed germination. If weeds have emerged, cultivate the soil before application. · **Do NOT** use on pumpkins. · Apply **ONLY** when plants have 4–5 true leaves, are well established and growing conditions are favourable for good plant growth otherwise crop injury may result. · Apply at a rate of 9–13.5 kg/ha (3.6–5.4 kg/acre) on light sand or sandy loam soils. · Apply at a rate of 11–15.5 kg/ha (4.4–6.2 kg/acre) on medium silt loam soils. · **Do NOT** use on muck soils. · Apply in at least 225 L/ha (90 L/acre) of water. · Rainfall or irrigation (about 1 cm) is necessary for activation.
napropamide (1.12–2.25 kg/ha)	DEVRINOL DF (50 DF) DEVRINOL DF-XT (50 DF-XT)	2.24–4.5 kg/ha (0.9–1.8 kg/acre)	· PRE – 1 application per season. · Use on direct seeded pumpkin and squash **ONLY**. · Apply in 200–900 L/ha (80–360 L/acre) water. · Use the lower rate on light soils (coarse textured, sandy or sandy loam). · Shepherd's purse and lady's-thumb may not be fully controlled at this rate. · Apply before rainfall if irrigation is not available. · Damage to subsequent crops and cover crops can be reduced by tillage across the rows after harvest. Small grains seeded in the fall may be stunted but not otherwise affected.
s-metolachlor/benoxacor (1.05–kg/ha)	DUAL II MAGNUM (915 g/L)	1.15 L/ha (0.47 L/acre)	· Apply prior to transplanting or within 48 hours after transplanting. · Apply PRE in direct seeded crops prior to weed emergence OR at the 1–2 leaf stage of the crop but still PRE to weed emergence. · Make **ONLY** 1 application per year. · **Do NOT** harvest within 30 days of treatment. · Reduced control in heavy weed populations may occur. · Risk of crop injury increases with cool and wet conditions. · Foliar contact can increase the potential to cause crop injury. Avoid overspray.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
MUSKMELON, WATERMELON, SQUASH AND PUMPKIN (cont'd)			
Postemergence Grass Herbicides			
quizalofop-p-ethyl (0.036–0.07 kg/ha) + oil concentrate (0.5% v/v)	ASSURE II (96 g/L) + MERGE	0.38–0.75 L/ha (0.15–0.3 L/acre) + 5 L/1,000 L	· Make 1 application per year when the crop is at the 2–6 leaf stage. · Apply at the labelled leaf stage of grassy weeds. · Use ground equipment only. Use a minimum of 100L/ha (40 L/acre) water. · **Do NOT** enter or allow worker entry into treated areas during the restricted entry interval of 4 days for scouting, irrigation and hand weeding activities. · **Do NOT** apply within 30 days of harvest.
	ASSURE II (96 g/L) + SURE-MIX		
	YUMA GL (96 g/L) + XA OIL CONCENTRATE		
sethoxydim (0.14–0.2 kg/ha) + surfactant/solvent (0.25–2 L/ha)	POAST ULTRA (450 g/L) + MERGE	0.32–1.1 L/ha (0.13–0.44 L/acre) + 0.25–2 L/ha (0.1–0.8 L/acre)	· For pumpkins and squash **ONLY**. · For annual grass, use 0.32 L/ha (0.13 L/acre). Apply at the 1–6 leaf stage. · For volunteer grains, use 0.47 L/ha (0.19 L/acre). · For quackgrass, use 1.1 L/ha (0.44 L/acre). Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days in wide row crops. Use the high rate of MERGE for quackgrass. · Use 100–200 L/ha (40–80 L/acre) water. · **Do NOT** apply if rain is expected within 1 hour after application. · **Do NOT** wait to spray broadleaf weeds if grassy weeds are not in the appropriate stage. · **Do NOT** apply closer than 30 days to harvest.
Postemergence Broadleaf Herbicides			
carfentrazone-ethyl (8.8–28.1 g/ha) + non-ionic surfactant (0.25% v/v)	AIM EC (240 g/L) + AGRAL 90	36.5–117 mL/ha (14.6–46.8 mL/acre) + 2.5 L/1,000 L	· Apply POST with a hooded sprayer between the rows. · Apply to actively growing weeds up to 10 cm tall. · Apply in a minimum of 100 L/ha (40 L/acre) water. · **Do NOT** apply closer than 1 day to harvest. · Apply **ONLY** once per growing season.
	AIM EC (240 g/L) + AG-SURF		
carfentrazone-ethyl (8.8–28.1 g/ha) + surfactant/solvent (0.1% v/v)	AIM EC (240 g/L) + MERGE	36.5–117 mL/ha (14.6–46.8 mL/acre) + 1 L/1,000 L	

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
MUSKMELON, WATERMELON, SQUASH AND PUMPKIN (cont'd)			
Postemergence Broadleaf Herbicides (cont'd)			
halosulfuron (25–51 g/ha) + non-ionic surfactant (0.2% v/v)	SANDEA (72.6 WG) + non-ionic surfactant	35–70 g/ha (14–28 g/acre) + 2.5 L/1,000 L	· Apply to row middles at all crop stages. · Apply to direct seeded or actively growing transplanted muskmelons, pumpkins and winter squash **ONLY** between 3–5 true leaf stage or 14 days after transplanting and appearance of first female flower. · Apply at a rate of 35–70 g/ha (14–28 g/acre) on muskmelon, direct seeded processing pumpkins and winter squash; 35–52.5 g/ha (14–21 g/acre) on watermelon, fresh market pumpkins and winter squash; and 47–70 g/ha (19–28 g/acre) on direct seeded processing summer squash. · Maximum of two applications per season with a minimum of 21 days between applications. · **Do NOT** apply more than 70 g/ha (28 g/acre) per season on watermelon, pumpkins and winter squash and 140 g/ha (56 g/acre) on muskmelon and summer squash. · Use a minimum water volume of 140 L/ha (56 L/acre) for muskmelons, pumpkins and winter squash and 190 L/ha (76 L/acre) for watermelon and processing summer squash. · **Do NOT** spray over top of plastic mulch as significant injury may result. · **Do NOT** harvest within 57 days after application for muskmelon and watermelon and 30 days for pumpkins and squash.
ONIONS			
Site Preparation Before Planting – See Chapter 6, Preplant & Postharvest Weed Control, page 91.			
Most experience with herbicides below has been with the seeded crop. Experience with sets and limited experience with Spanish onions have been satisfactory. On green bunching onions, the granular formulations (applied when the leaves are dry) help to avoid leaf injury.			
Soil Applied Grass and Broadleaf Herbicides			
flumioxazin (0.07 kg/ha)	CHATEAU WDG (51.1%)	0.14 kg/ha (0.056 kg/acre)	· Apply ONCE per season. · Apply to transplanted onions between the 2–6 leaf stage and on direct seeded onions between the 3–6 leaf stage prior to weed emergence. · Apply to coarse and medium textured soils with less than 5% organic matter and to muck soils. · Apply using ground application **ONLY**. · **Do NOT** apply through irrigation equipment. · Severe crop injury will result when soils are flooded or poorly drained following application and/or if applications are made under cool, wet conditions. · After use, tanks and nozzles must be cleaned with a 3% ammonia solution. Please review label for more detailed instructions. · **Do NOT** harvest within 45 days of treatment.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
ONIONS (cont'd)			
Soil Applied Grass and Broadleaf Herbicides (cont'd)			
chlorthal dimethyl (6.75–13.5 kg/ha)	DACTHAL W-75 (75 WP)	9–18 kg/ha (3.6–7.2 kg/acre)	· PRE – Apply immediately after seeding or directly over transplants, preemergence to weeds. · Apply at a rate of 9–13.5 kg/ha (3.6–5.4 kg/acre) on light sand or sandy loam soils. · Apply at a rate of 11–15.5 kg/ha (4.4–6.2 kg/acre) on medium silt loam soils. · Apply at a rate of 18 kg/ha (7.2 kg/acre) on heavy clay soils. · **Do NOT** use on muck soils. · Apply in at least 225 L/ha (90 L/acre) of water. · Remove weeds by cultivating before application. · Rainfall or irrigation (about 1 cm) is necessary for activation.
pendimethalin (1.08 kg/ha)	PROWL H2O (455 g/L)	2.37 L/ha (0.95 L/acre)	· Apply as a single application at the 2 to 3 leaf stage of green onions and dry bulb onions or after transplanting leeks, before weed emergence. · Destroy existing weeds prior to application. · **Do NOT** use on Muck soils if growing leeks, green (bunching) onions or onions grown from sets. · **Do NOT** apply PROWL H2O with liquid fertilizers. · Apply in a minimum of 200 L/ha (80 L/acre) water. · Best results occur when rainfall or irrigation is received within 7 days after application. · **Do NOT** apply within 30 days of harvest.
Postemergence Grass Herbicides			
fenoxaprop-p-ethyl (0.054 kg/ha)	EXCEL SUPER (80.5 g/L)	0.67 L/ha (0.27 L/acre)	· Apply to annual grasses in the 1–6 leaf stage, or until volunteer corn is 25 cm tall. · Annual grasses will not be controlled if emergence occurs after application. · Apply to dry bulb onions **ONLY**. · **Do NOT** apply if rain is expected within 1 hr after application. · Preharvest interval is 38 days.
dimethenamid (0.69–0.93 kg/ha)	FRONTIER MAX (720 g/L)	0.963–1.29 L/ha (0.39–0.52 L/acre)	• **DRY BULB ONIONS**: · Apply **ONLY** at the loop stage of onion. · FRONTIER MAX will only suppress yellow nutsedge when applied prior to emergence on muck soils. · Apply only once per growing season. · Pre-harvest interval is 60 days. • **GREEN ONIONS**: · Redroot pigweed and eastern black nightshade will be controlled in green onions grown on mineral soil. There will be reduced competition from redroot pigweed and yellow nutsedge will be suppressed in green onions grown on muck soil. · Apply alone as a single application at a rate of 963 mL/ha (0.39 L acre) to green onions on mineral soil and 1.29 L/ha (0.52 L/acre) on muck soil at the loop stage and before weed emergence. Application made prior to the loop stage of green onion may result in significant crop injury, including possible stand reduction. · Emerged weeds will not be controlled. · Avoid application under cool conditions as stunting may result. · Pre-harvest interval is 30 days.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	**TRADE NAME (concentration)**	**PRODUCT RATE**	**PRECAUTIONS** For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
ONIONS (cont'd)			
Postemergence Grass Herbicides (cont'd)			
sethoxydim (0.14–0.5 kg/ha) + surfactant/solvent (0.25–2 L/ha)	POAST ULTRA (450 g/L) + MERGE	0.32–1.1 L/ha (0.13–0.44 L/acre) + 0.25–2 L/ha (0.1–0.8 L/acre)	· For dry bulb onions **ONLY**. · For annual grass, use 0.32 L/ha (0.13 L/acre). Apply at the 1–6 leaf stage. · For volunteer grains, use 0.47 L/ha (0.19 L/acre). · For quackgrass, use 1.1 L/ha (0.44 L/acre). Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days in wide row crops. Use the high rate of MERGE for quackgrass. · Use 100–200 L/ha (40–80 L/acre) water. · **Do NOT** apply if rain is expected within 1 hour after application. · **Do NOT** apply closer than 50 days to harvest.
clethodim (0.09 L/ha) + surfactant (0.5% v/v)	SELECT (240 g/L) + AMIGO SELECT (240 g/L) + ARROW (240 g/L)	0.38 L/ha (0.15 L/acre) + 5 L/1,000 L	· For use on dry bulb onions. · For suppression of annual bluegrass and the control of other annual grasses and quackgrass. · See label for detailed information on rates to control all annual grasses. · Apply using ground equipment. · Apply when the crop is in the 1–4 leaf stage and grassy weeds are in the 2–6 leaf stage. · **Do NOT** exceed 1 application per year. · **Do NOT** harvest for 45 days after application.
fluazifop-p-butyl (0.075–0.25 kg/ha)	VENTURE L (125 g/L)	0.6–2 L/ha (0.24–0.8 L/acre)	· Apply POST to actively growing grasses before tillering. · Apply at 0.6 L/ha (0.24 L/acre) at 2–5 leaf stage of volunteer corn. · Apply at 0.8 L/ha (0.32 L/acre) at 2–5 leaf stage of volunteer wheat and barley. · Apply 1 L/ha (0.4 L/acre) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails). · Apply at 2 L/ha (0.8 L/acre) at 3–5 leaf stage of quackgrass and wirestem muhly. · Apply in a maximum volume of 300 L/ha (120 L/acre). · Fragmenting quackgrass rhizomes with thorough preplant tillage improves control. · **Do NOT** cultivate between rows until 5 days after application. · If using a rate of 1 L/ha (0.4 L/acre), **Do NOT** apply closer than 42 days before harvest. · If using a rate of 2 L/ha (0.8 L/acre), **Do NOT** apply closer than 60 days before harvest.
Postemergence Broadleaf Herbicides			
carfentrazone-ethyl (8.8–28.1 g/ha) + non-ionic surfactant (0.25% v/v)	AIM EC (240 g/L) + AGRAL 90 AIM EC (240 g/L) + AG-SURF	36.5–117 mL/ha (14.–46.8 mL/acre) + 2.5 L/1,000 L	· Apply POST with a hooded sprayer between the rows. · Apply to actively growing weeds up to 10 cm tall. · Apply in a minimum of 100 L/ha (40 L/acre) water. · **Do NOT** apply closer than 1 day to harvest. · Apply **ONLY** once per growing season.
carfentrazone-ethyl (8.8–28.1 g/ha) + surfactant/solvent (0.1% v/v)	AIM EC (240 g/L) + MERGE	36.5–117 mL/ha (14.–46.8 mL/acre) + 1 L/1,000 L	

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used In Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
ONIONS (cont'd)			
Postemergence Broadleaf Herbicides (cont'd)			
oxyfluorfen (0.12 kg/ha)	GOAL 2XL (240 g/L)	0.5 L/ha (0.2 L/acre)	· Apply after onions have 2 fully developed leaves and when weeds are in the 2–4 leaf stage. · Apply in minimum of 500 L/ha (200 L/acre) water. · **Do NOT** exceed a total of 2.0 L/ha (0.8 L/acre) per year. · **Do NOT** harvest within 56 days of treatment. · **Do NOT** apply to sandy soil.
bromoxynil (0.14 kg/ha)	PARDNER (280 g/L)	0.5 L/ha (0.2 L/acre)	· For use **ONLY** on dry bulb onions. · Apply POST to actively growing pigweed and common groundsel up to the 4 leaf stage. · Apply when onions are at the 2–3 leaf stage, repeat application when onions are at the 4–5 leaf stage. · Apply in 200 L/ha (80 L/acre) water at a pressure of 170 kPa. · **Do NOT** harvest within 75 days of application. · Severe leaf burn may result in onions if weather conditions have not been conducive to the development of the outer waxy layer of the onion leaf.
	BROMOTRIL (240 g/L)	0.6 L/ha (0.24 L/acre)	
Postemergence Grass and Broadleaf Herbicides			
pendimethalin (1–1.5 kg/ha)	PROWL H2O (455 g/L)	2.2–3.3 L/ha (0.89–1.34 L/acre)	· For mineral soils, use on direct seeded dry bulb onions. · Apply at the 2–6 leaf stage of crop development for season long control. · Destroy existing weeds prior to application. · **Do NOT** exceed more than two applications a year. · Apply in a minimum of 250 L/ha (100 L/acre) water. · Best results occur when rainfall or irrigation is received within 7 days after application.
pendimethalin (3 kg/ha)	PROWL H2O (455 g/L)	6.6 L/ha (2.67 L/acre)	· For muck soils, use on direct seeded dry bulb onions. · Apply at the loop and/or 2 leaf stage of crop development for season long control. Application at both growth stages is required for season-long control. · Destroy existing weeds prior to application. · **Do NOT** exceed more than two applications a year. · Apply in a minimum of 250 L/ha (100 L/acre) water. · Best results occur when rainfall or irrigation is received within 7 days after application.
PARSNIPS			
Site Preparation Before Planting – See Chapter 6, Preplant & Postharvest Weed Control, page 91.			
Soil Applied Grass and Broadleaf Herbicides			
linuron (0.625–1.2 kg/ha)	LOROX DF (50 DF)	1.25–2.4 kg/ha (0.5–0.96 kg/acre)	· PRE – Apply soon after seeding, prior to crop emergence. · Plant seed at least 1.3 cm deep. · Use a rate of 1.25–1.82 kg/ha (0.73–0.96 kg/acre) on loam or clay soil with low organic matter. · Use a rate of 1.82–2.4 kg/ha (0.73–0.96 kg/acre) on muck soil or clay soil with medium organic matter. · Heavy rains or irrigation at time of emergence may cause injury. · An additional postemergence treatment may be needed. · **Do NOT** apply within 60 days of harvest.
	LOROX L (480 g/L)	1.25–2.4 L/ha (0.5–0.96 L/acre)	

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
PARSNIPS (cont'd)			
Soil Applied Grass and Broadleaf Herbicides (cont'd)			
linuron (0.625–0.91 kg/ha) followed by linuron (0.625–1.2 kg/ha)	LOROX DF (50 DF) followed by LOROX DF (50 DF)	1.25–1.82 kg/ha (0.5–0.73 kg/acre) followed by 1.25–2.4 kg/ha (0.5–0.96 kg/acre)	· PRE (maximum 1.82 kg/ha or 0.73 kg/acre), followed by POST (maximum 2.4 kg/ha or 0.96 kg/acre). · These treatments must be applied at least 2 weeks apart or crop injury may result. · **Do NOT** apply more than these 2 applications per season and **do NOT** use higher rates. · Observe instructions for both PRE and POST use carefully before using. · **Do NOT** apply within 60 days of harvest.
	LOROX DF (50 DF) followed by LOROX L (480 g/L)	1.25–1.82 kg/ha (0.5–0.73 kg/acre) followed by 1.25–2.4 L/ha (0.5–0.96 L/acre)	
	LOROX L (480 g/L) followed by LOROX DF (50 DF)	1.25–1.82 L/ha (0.5–0.73 L/acre) followed by 1.25–2.4 kg/ha (0.5–0.96 kg/acre)	
	LOROX L (480 g/L) followed by LOROX L (480 g/L)	1.25–1.82 L/ha (0.5–0.73 L/acre) followed by 1.25–2.4 L/ha (0.5–0.96 L/acre)	
Postemergence Broadleaf Herbicides			
carfentrazone-ethyl (8.8–28.1 g/ha) + non-ionic surfactant (0.25% v/v)	AIM EC (240 g/L) + AGRAL 90	36.5–117 mL/ha (14.6–46.8 mL/acre) + 2.5 L/1,000 L	· Apply POST with a hooded sprayer between the rows. · Apply to actively growing weeds up to 10 cm tall. · Apply in a minimum of 100 L/ha (40 L/acre) water. · **Do NOT** apply closer than 1 day to harvest. · Apply **ONLY** once per growing season.
	AIM EC (240 g/L) + AG-SURF		
carfentrazone-ethyl (8.8–28.1 g/ha) + surfactant/solvent (0.1% v/v)	AIM EC (240 g/L) + MERGE	36.5–117 mL/ha (14.6–46.8 mL/acre) + 1 L/1,000 L	
Postemergence Grass Herbicides			
clethodim (46–91 g/ha) + surfactant (0.5–1% v/v)	CENTURION (240 g/L) + AMIGO SELECT (240 g/L) + AMIGO	0.19–0.38 L/ha (0.08–0.15 L/acre) + 5–10 L/1,000 L	· For the control of annual grasses and quackgrass. · See label for detailed information on rates to control all annual grasses. · Apply using ground equipment. · Apply in a minimum of 110 L/ha (44 L/acre) water for SELECT and 200 L/ha (80 L/acre) water for CENTURION. · Apply when grassy weeds are at 2–6 leaf stage. · **Do NOT** exceed 2 applications per year and 0.38 L/ha (0.15 L/acre). · **Do NOT** apply within 30 days of harvest.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
PARSNIPS (cont'd)			
Postemergence Grass and Broadleaf Herbicides			
linuron (0.91–2.26 kg/ha)	LOROX DF (50 DF)	1.82–4.51 L/ha (0.73–1.80 kg/acre)	· Apply when the crop has 2 or more fully developed leaves. · Use lower rates on small seedling weeds and higher rates on established weeds. · On muck soils, parsnips must be more than 8 cm tall when spraying. · **Do NOT** mix with oil or other surfactants. · Apply in 220–440 L/ha (88–176 L/acre) water. · Apply before annual grasses exceed 5 cm and before broadleaf weeds exceed 15 cm. · During hot, dry weather, spray in the cool part of the day to avoid crop injury. · Nozzle pressure must not exceed 275 kPa as crop injury may result. · If unusually heavy rains follow application, severe injury may result. · **Do NOT** apply within 60 days of harvest.
linuron (0.91–2.26 L/ha)	LOROX L (480 g/L)	1.82–4.51 L/ha (0.73–1.80 L/acre)	
PEAS			
Site Preparation Before Planting – See Chapter 6, Preplant & Postharvest Weed Control, page 91.			
Soil Applied Broadleaf Herbicides			
prometryne (1.8–2.2 kg/ha)	GESAGARD 480 (480 g/L)	3.75–4.58 L/ha (1.5–1.83 L/acre)	· PRE – Apply only once per year before weeds emerge, including eastern black nightshade. · Apply in 200–1,000 L/ha (80–400 L/acre) water. · Dry soil may need light incorporation. · Use lower rate on sandy soils. · Preharvest interval is 55 days.
Soil Applied Grass and Broadleaf Herbicides			
s-metolachlor/benoxacor (1.14–1.6 kg/ha)	DUAL II MAGNUM (915 g/L)	1.25–1.75 L/ha (0.5–0.7 L/acre)	· PRE – Apply by ground application equipment **ONLY**. · **Do NOT** use on muck, peat, high organic matter soils or soils with less than 1% organic matter. · Use the higher rate for heavier weed populations. · Apply in 150–250 L/ha (60–100 L/acre) water.
imazethapyr (0.075 kg/ha)	PURSUIT (240 g/L)	0.312 L/ha (0.125 L/acre)	· PPI or PRE – only once per year. · Apply in 200 L/ha (80 L/acre) water. · Allow at least 24 months between PPI applications. · Preharvest interval is 50 days.
	PHANTOM (240 g/L)		
	NU-IMAGE (240 g/L)		
trifluralin (0.6–0.8 kg/ha)	TREFLAN EC(480 g/L)	1.2–1.7 L/ha (0.5–0.7 L/acre)	· PPI – Incorporate within 24 h of application. · **Do NOT** exceed the low rate on medium textured soils. · **Do NOT** exceed the high rate on heavy textured soils. · **Do NOT** apply to peat or muck soils (greater than 15% organic matter). · **Do NOT** apply to soils with less than 2% organic matter. · **Do NOT** apply to fields spread with manure within the last 12 months. · **Do NOT** apply by air.
	RIVAL EC (500 g/L)	1.2–1.6 L/ha (0.5–0.64 L/acre)	
	BONANZA 480 (480 g/L)	1.25–1.7 L/ha (0.5–0.68 L/acre)	

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
PEAS (cont'd)			
Postemergence Grass Herbicides			
quizalofop-p-ethyl (0.036–0.07 kg/ha) + oil concentrate (0.5% v/v)	ASSURE II (96 g/L) + SURE-MIX	0.38–0.75 L/ha (0.15–0.3 L/acre) + 5 L/1,000 L	· Apply to emerged annual grasses and volunteer cereals in 2 leaf to tillering stage and volunteer corn and quackgrass in the 2–6 leaf stage. · Use the 0.38 L/ha (0.15 L/acre) rate for control of volunteer corn, volunteer cereals and green foxtail. · The 0.5 L/ha (0.2 L/acre) rate will suppress quackgrass and also control barnyard grass. · Use the 0.75 L/ha (0.3 L/acre) rate for control of quackgrass. · **Do NOT** harvest within 65 days after application.
	YUMA GL (96 g/L) + XA Oil Concentrate		
sethoxydim (0.14–0.5 kg/ha) + surfactant/solvent (0.25–2 L/ha)	POAST ULTRA (450 g/L) + MERGE	0.32–1.1 L/ha (0.13–0.44 L/acre) + 0.25–2 L/ha (0.1–0.8 L/acre)	· For annual grass, use 0.32 L/ha (0.13 L/acre). Apply at the 1–6 leaf stage (2–5 is optimum). · For volunteer grains, use 0.47 L/ha (0.19 L/acre). Apply at the 1–6 leaf stage (2–5 is optimum). · For quackgrass, use 1.1 L/ha (0.44 L/acre). Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days in wide row crops. Use the high rate of MERGE for quackgrass. · Grasses emerging after application will not be controlled. · Use 100–200 L/ha (40–80 L/acre) water. · **Do NOT** apply herbicides other than MCPA SODIUM 300 or PURSUIT within 4 days of application. · **Do NOT** graze treated crop. · Spray tips angled forward 45° will give better coverage. · **Do NOT** use flood jet or hollow cone nozzles. · **Do NOT** apply if rain is expected within 1 h after application. · Use **ONLY** on fresh or dry processing peas, not on fresh edible pod peas. · Preharvest interval is 30 days for fresh processing peas. · Preharvest interval is 60 days for dry peas.
Postemergence Broadleaf Herbicides			
carfentrazone-ethyl (8.8–28.1 g/ha) + non-ionic surfactant (0.25% v/v)	AIM EC (240 g/L) + AGRAL 90	36.5–117 mL/ha (14.6–46.8 mL/acre) + 2.5 L/1,000 L	· Apply POST with a hooded sprayer between the rows. · Apply to actively growing weeds up to 10 cm tall. · Apply in a minimum of 100 L/ha (40 L/acre) water. · **Do NOT** apply closer than 1 day to harvest. · Apply **ONLY** once per growing season.
	AIM EC (240 g/L) + AG-SURF		
carfentrazone-ethyl (8.8–28.1 g/ha) + surfactant/solvent (0.1% v/v)	AIM EC (240 g/L) + MERGE	36.5–117 mL/ha (14.6–46.8 mL/acre) + 1 L/1,000 L	

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
PEAS (cont'd)			
Postemergence Broadleaf Herbicides (cont'd)			
bentazon (0.84–1.08 kg/ha) + surfactant (0.125–0.25% v/v)	BASAGRAN (480 g/L) + SUPER SPREADER	1.75–2.25 L/ha (0.7–0.9 L/acre) + 1.25–2.5 L/1,000 L	· Apply POST when peas have at least 3 pairs of leaves and before flowering. · Under hot, humid conditions reduce ASSIST oil concentrate to 1 L/ha (0.4 L/acre). · Refer to the BASAGRAN label for information on specific weed stage and height. Two applications, 10 days apart, of 1.75 L/ha (0.7 L/acre) may be required for top growth control of nutsedge and Canada thistle, and suppression of field bindweed. · **Do NOT** apply if rain is expected within 6 h after application. · Apply the higher rate of SUPER SPREADER if hard water is being used.
bentazon (0.84–1.08 kg/ha) + oil concentrate	BASAGRAN (480 g/L) + ASSIST	1.75–2.25 L/ha (0.7–0.9 L/acre) + 1–2 L/ha (0.4–0.8 L/acre)	
MCPA* (0.3–0.45 kg/ha)	MCPA SODIUM 300 (300 g/L)*	1–1.5 L/ha (0.4–0.6 L/acre)	· Apply POST when peas are 10–20 cm high. · **Do NOT** apply after flower buds have formed on peas. · **Do NOT** apply when temperatures are over 27°C, high humidity, or under drought conditions. · **Do NOT** apply by air. · Apply in at least 150 L/ha (60 L/acre) water. · Apply the lower rate of MCPA AMINE for control of wild mustard. * See Table 4–1. Herbicides Used in Ontario, page 30, for formulations available. Not all formulations registered on all crops. See label for specific uses and rates.
MCPA* (0.275–0.35 kg/ha)	MCPA AMINE (500 g/L)*	0.55–0.7 L/ha (0.22–0.28 L/acre)	
MCPB/MCPA (1.1–1.7 kg/ha)	TROPOTOX PLUS (400 g/L)	2.75–4.25 L/ha (1.1–1.7 L/acre)	· Apply POST when peas have 3–6 expanded leaves. · **Do NOT** apply after the 6 leaf stage as damage may occur. · **Do NOT** apply when temperatures are over 27°C, high humidity, or under drought conditions. · **Do NOT** apply by air. · **Do NOT** graze or cut treated crop for forage. · Top growth only: Canada thistle, creeping buttercup, field bindweed, horsetail, perennial sow-thistle, tall buttercup. · Apply only ONCE a year.
	CLOVITOX PLUS (400 g/L)		
	TOPSIDE (400 g/L)		

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
PEPPERS			
Site Preparation Before Planting – See Chapter 6, Preplant & Postharvest Weed Control, page 91.			
All treatments should be applied in 150–300 L/ha (60–120 L/acre) water. Discussion of cultural methods can be found in the Tomatoes (Transplanted) section, page 318. Weed control in peppers is best accomplished by combining chemical and cultural methods.			
Soil Applied Broadleaf Herbicides			
halosulfuron (25–51 g/ha)	SANDEA (72.6 WG)	35–70 g/ha (14–28 g/acre)	· For use on chile, bell and banana peppers. · Apply only to row middle for direct seeded or transplanted peppers. · Apply as a single or split application of 35–70 g/ha (14–28 g/acre), allow a minimum of 21 days between applications. · Do not apply more than 140 g/ha (56 g/acre) per season. · Use a minimum water volume of 190 L/ha (76 L/acre). · Rains greater than 1 inch within 5–7 days of application may cause temporary yellowing and delay development of crop. · **Do NOT** spray over top of plastic mulch. · **Do NOT** harvest within 30 days after application.
Soil Applied Grass and Broadleaf Herbicides			
flumioxazin (0.07154–0.1073 kg/ha)	CHATEAU WDG (51.1%)	0.14–0.21 kg/ha (0.056–0.084 kg/acre)	· Apply before transplanting field peppers. · Apply the higher rate to medium-textured soils and the lower rate to coarse-textured soils. · Apply product with a hooded or shielded sprayer to row middles. · **Do NOT** apply more than 0.21 kg/ha (0.084 kg/acre) a season. · Peppers should be planted in raised or plastic mulch beds. See product label for bed requirements. · Apply to all coarse and medium textured soils with less than 5% organic matter. · Rainfall or irrigation is required after transplanting and before application. · **Do NOT** apply through irrigation equipment. · After use, tanks and nozzles must be cleaned with a 3% ammonia solution. Please review label for more detailed instructions.
clomazone (0.558–0.846 kg/ha)	COMMAND 360 ME (360 g/L)	1.55–2.35 L/ha (0.62–0.95 L/acre)	· **Do NOT** use on banana peppers. · **Do NOT** make more than 1 application per season. · Apply before transplant and prior to weed emergence. Place roots of the transplants below the chemical barrier when planting. · Use the lower labeled rate on coarse soils and the higher labeled rate on fine soils. · **Do NOT** apply within 70 days of harvest. · **Do NOT** incorporate. · **Do NOT** apply to sandy soil. · Use ground equipment only.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
PEPPERS (cont'd)			
Soil Applied Grass and Broadleaf Herbicides (cont'd)			
chlorthal dimethyl (6.75–11.625 kg/ha)	DACTHAL W-75 (75 WP)	9–15.5 kg/ha (3.6–6.2 kg/acre)	· PRE – If weeds have emerged, cultivate the soil before application. · Apply 4–6 weeks after transplanting or when direct seeded plants have reached a height of 10–15 cm. · Apply at a rate of 9–13.5 kg/ha (3.6–5.4 kg/acre) on light sand or sandy loam soils. · Apply at a rate of 11–15.5 kg/ha (4.4–6.2 kg/acre) on medium silt loam soils. · **Do NOT** use on muck soils. · Apply in at least 225 L/ha (90 L/acre) of water. · Rainfall or irrigation (about 1 cm) is necessary for activation.
napropamide (1.12–2.25 kg/ha)	DEVRINOL DF (50 DF)	2.25–4.5 kg/ha (0.9–1.8 kg/acre)	· PPI – Incorporate within 24 h of application. · **Do NOT** apply to soils with over 10% organic matter. · Damage to subsequent cover crops can be reduced by tillage across the rows after harvest. Small grains seeded in the fall may be stunted but not otherwise affected.
	DEVRINOL DF-XT (50 DF-XT)		
s-metolachlor/benoxacor (1.05–1.14 kg/ha)	DUAL II MAGNUM (915 g/L)	1.15–1.25 L/ha (0.46–0.5 L/acre)	· Apply within 48 h of transplanting peppers and PRE to weeds. · Risk of crop injury increases with early transplanting and soil temperatures below 10°C. · Applications made more than 48 h after transplanting may increase the risk of foliar injury. · **Do NOT** harvest peppers within 80 days of application. · **Do NOT** apply to soils that contain less than 1% or more than 10% organic matter. · Make **ONLY** 1 application per year. · Apply by ground application. · Apply in a minimum spray volume of 150 L/ha (60 L/acre) of water. · **Do NOT** tank-mix with fluid fertilizers, oil, oil concentrates or surfactants.
trifluralin (0.58–1.15 kg/ha)	TREFLAN EC (480 g/L)	1.2–2.4 L/ha (0.5–0.96 L/acre)	· PPI – Incorporate within 24 h of application. · Apply in at least 100 L/ha (40 L/acre) water. · **Do NOT** exceed the low rate on medium textured soils. · **Do NOT** apply to peat or muck soils (greater than 15% organic matter). · **Do NOT** apply to soils with less than 2% organic matter. · **Do NOT** apply to fields spread with manure within the last 12 months. · **Do NOT** apply by air. · **Do NOT** apply on the same land for 2 consecutive years.
	RIVAL EC (500 g/L)	1.2–2.3 L/ha (0.48–0.92 L/acre)	
	BONANZA 480 (480 g/L)	1.25–2.3 L/ha (0.5–0.92 L/acre)	

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
PEPPERS (cont'd)			
Postemergence Grass Herbicides			
sethoxydim (0.14–0.5 kg/ha) + surfactant/solvent (0.25–2 L/ha)	POAST ULTRA (450 g/L) + MERGE	0.32–1.1 L/ha (0.13–0.44 L/acre) + 0.25–2 L/ha (0.1–0.8 L/acre)	· For annual grass, use 0.32 L/ha (0.13 L/acre). Apply at the 1–6 leaf stage. · For volunteer grains, use 0.47 L/ha (0.19 L/acre). · For quackgrass, use 1.1 L/ha (0.44 L/acre). Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days in wide row crops. Use the high rate of MERGE for quackgrass. · Grasses emerging after application will not be controlled. · Use 100–200 L/ha (40–80 L/acre) water. · Spray tips angled forward 45° will give better coverage. · **Do NOT** use flood jet or hollow cone nozzles. · **Do NOT** apply if rain is expected within 1 h after application. · **Do NOT** apply closer than 30 days to harvest.
Postemergence Broadleaf Herbicides			
carfentrazone-ethyl (8.8–28.1 g/ha) + non-ionic surfactant (0.25% v/v)	AIM EC (240 g/L) + AGRAL 90 AIM EC (240 g/L) + AG-SURF	36.5–117 mL/ha (14.6–46.8 mL/acre) + 2.5 L/1,000 L	· Apply POST with a hooded sprayer between the rows. · Apply to actively growing weeds up to 10 cm tall. · Apply in a minimum of 100 L/ha (40 L/acre) water. · **Do NOT** apply closer than 1 day to harvest. · Apply **ONLY** once per growing season.
carfentrazone-ethyl (8.8–28.1 g/ha) + surfactant/solvent (0.1% v/v)	AIM EC (240 g/L) + MERGE	36.5–117 mL/ha (14.6–46.8 mL/acre) + 1 L/1,000 L	
halosulfuron (25–51 g/ha) + non-ionic surfactant (0.2% v/v)	SANDEA (72.6 WG) + non-ionic surfactant	35–70 g/ha (14–28 g/acre) + 2.5 L/1,000 L	· For use on chile, bell and banana peppers · Apply to row middle for direct seeded or transplanted peppers. · A directed spray can be applied at 21 days after transplanting or when plants have reached a height of 15 cm, but before flowering. · Apply as a single or split application of 35–70 g/ha (14–28 g/acre), allow a minimum of 21 days between applications. · **Do NOT** apply more than 140 g/ha (56 g/acre) per season. · Use a minimum water volume of 190 L/ha (76 L/acre). · **Do NOT** spray over top of plastic mulch. · **Do NOT** harvest within 30 days after application.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
POTATOES			
Site Preparation Before Planting – See Chapter 6, Preplant & Postharvest Weed Control, page 91.			
The best weed management system for potato uses a combination of chemical weed control with cultivation and other techniques. Cultivation prior to potato emergence using various kinds of cultivation equipment (light harrows, finger weeders, hillers, etc.) will control the early flush of weeds. Root pruning of the crop should be minimized. If the crop is hilled after application of herbicides, untreated soil will surface and another flush of weeds may result. POTATO VINE KILLING – For information on products and rates of application of vine killing, consult OMAFRA Publication 838, *Vegetable Crop Protection Guide*, and follow the product label.			
Soil Applied Broadleaf Herbicides			
linuron (1.1–2.15 kg/ha)	LOROX DF (50 DF)	2.2–4.3 kg/ha (0.88–1.72 kg/acre)	· PRE – Apply immediately after hilling. The potato tops must be covered with soil to avoid injury. · Use the lower rate on light sandy soils and the higher rate on muck or clay soils. · Apply before grasses are 5 cm tall and before broadleaf weeds are 15 cm tall.
linuron (1.1–2.15 L/ha)	LOROX L (480 g/L)	2.2–4.3 L/ha (0.88–1.72 L/acre)	
fomesafen (0.24 kg/ha)	REFLEX (240 g/L)	1 L/ha (0.4 L/acre)	· Apply PRE after planting but prior to potato emergence. · For preemergence control of redroot pigweed, common ragweed and lamb-quarter's (suppression only). · If weeds are emerged at time of application, include a non-ionic adjuvant, such as AGRAL 90 at 0.1% v/v. · **Do NOT** apply on soils with >5% organic matter or fine textured soils. · **Do NOT** cultivate for 7 days after application as effectiveness will be reduced. · **Do NOT** apply REFLEX to any field more than once every two years. · **Do NOT** harvest within 70 days of application. · Apply by ground application **ONLY**. · Some rotational cropping restrictions apply (see Table 4–4. Herbicide Crop Rotation and Soil pH Restrictions: Field Crops, on page 74).
Soil Applied Grass and Broadleaf Herbicides			
s-metolachlor/ metribuzin (1,443 g/ha–1,943 g/ ha)	BOUNDARY LQD (628 g/L + 149 g/L)	1.85–2.5 L/ha (0.74–1 L/acre)	· **Do NOT** apply at ground crack or if potatoes have emerged. · **Do NOT** apply to coarse textured soils with less than 1% organic matter. · **Do NOT** apply to varieties Belleisle, Tobique or Superior. · **Do NOT** harvest within 60 days of application. · Apply after hilling. Hilling operations made after application will reduce weed control.
s-metolachlor/ benoxacor (1.14–1.6 kg/ha)	DUAL II MAGNUM (915 g/L)	1.25–1.75 L/ha (0.5–0.7 L/acre)	· PRE or PPI (for nutsedge control). · **Do NOT** use on the variety Superior. · **Do NOT** apply on sandy or coarse textured soils low in organic matter. · **Do NOT** apply at ground crack or if potatoes have emerged.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
POTATOES (cont'd)			
Soil Applied Grass and Broadleaf Herbicides (cont'd)			
flumioxazin (0.054 kg/ha)	CHATEAU WDG (51.1%)	0.105 kg/ha (0.042 kg/acre)	· **Do NOT** apply after cracking. · Apply ONCE per season after hilling for the preemergence suppression of labeled weeds. · A minimum of 5 cm of soil must cover the vegetative portion of the potato plant at the time of application. Application to potatoes with less than 5 cm soil coverage may result in crop injury. · Apply to all coarse and medium textured soils with less than 5% organic matter. · Apply using ground application **ONLY.** · **Do NOT** apply through irrigation equipment. · Crop Injury may occur if applied at hilling. · After use, tanks and nozzles must be cleaned with a 3% ammonia solution. Please review label for more detailed instructions.
EPTC (3.4–6.8 kg/ha)	EPTAM (800 g/L)	4.25–8.5 L/ha (1.7–3.4 L/acre)	· PPI – Apply to a dry soil surface before planting and incorporate immediately, at next to the last or last cultivation for grass escapes. Use at 1.7–2.2 L/acre. · Avoid wet soil conditions or weed control may be poor. · Use 2.2–3.4 L/acre rates for heavy weed infestations and nutsedge control.
dimethenamid-p (544–693 g/ha)	OUTLOOK (720 g/L)	756–963 mL/ha (306–390 mL/acre)	· Apply PRE before weeds emerge and after planting. · **Do NOT** apply before planting or onto emerged potatoes as injury may result. · **ONLY** 1 application per year. · Use ground equipment **ONLY. Do NOT** apply during periods of dead calm. Avoid application of this product when winds are gusty. **Do NOT** apply with spray droplets smaller than the American Society of Agricultural Engineers (ASAE) medium classification. Boom height must be 60 cm or less above the crop or ground. · **Do NOT** apply within 40 days prior to harvest. · **Do NOT** graze or feed treated crop to livestock prior to 40 days after application. · Minimum spray volume of 100 L/ha (40 L/acre). · Rainfall is required within 7–10 days of treatment to activate and move OUTLOOK into the soil zone. · In cold and wet growing conditions, delayed emergence or early season stunting of potatoes may result. · Restricted-entry interval is 24 h.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
POTATOES (cont'd)			
Soil Applied Grass and Broadleaf Herbicides (cont'd)			
metribuzin (0.4–1.1 kg/ha)	SENCOR 480 F (480 g/L)	0.85–2.25 L/ha (0.34–0.9 L/acre)	· PRE – Apply after hilling before emergence of crop or weeds, or POST before weeds are 4 cm tall. · Use the lower rate on sandy soil. · Apply higher rates to longer season potatoes, or when longer weed control is needed. · Apply in 100–300 L/ha (40–120 L/acre) water. · **Do NOT** use on muck soils. · **Do NOT** use on coarse soils that have less than 2% organic matter. · **Do NOT** use on Belleisle and Tobique varieties. · When growing new or potentially sensitive varieties (such as early maturing, red-skinned, Atlantic, Eramosa or Shepody) first use of SENCOR herbicide should be limited to a small test area to ensure risk or level of potential injury is acceptable to the grower prior to adoption as a general field practice. · **Do NOT** exceed a total application rate of 1.1 kg active/ha (0.44 kg active/acre) per year. · **Do NOT** harvest for 60 days after application.
Soil Applied Tank-Mix Options			
s-metolachlor/ benoxacor (1.14–1.6 kg/ha) + linuron (0.88–1.13 kg/ha)	DUAL II MAGNUM (915 g/L) + LOROX DF (50 DF)	1.25–1.75 L/ha (0.5–0.7 L/acre) + 1.75–2.25 kg/ha (0.7–0.9 kg/acre)	· PRE – Apply after first hilling before emergence of the crop and weeds. · See Precautions for DUAL II MAGNUM and for LOROX above. · **Do NOT** use on the variety Superior.
s-metolachlor/ benoxacor (1.14–1.6 kg/ha) + linuron (0.88–1.13 L/ha)	DUAL II MAGNUM (915 g/L) + LOROX L (480 g/L)	1.25–1.75 L/ha (0.5–0.7 L/acre) + 1.75–2.25 L/ha (0.7–0.9 L/acre)	
s-metolachlor/ benoxacor (1.14–1.6 kg/ha) + metribuzin (0.53–1.08 kg/ha)	DUAL II MAGNUM (915 g/L) + SENCOR 480 F (480 g/L)	1.25–1.75 L/ha (0.5–0.7 L/acre) + 1.1–2.25 L/ha (0.44–0.9 L/acre)	· PPI or PRE – Apply after the first hilling before emergence of the crop and weeds. · See Precautions for DUAL II MAGNUM above. · **Do NOT** use on Superior, Belleisle, or Tobique potatoes. · **Do NOT** apply on sandy or on coarse textured soils low in organic matter, or on muck soils. · **Do NOT** apply at ground crack or if potatoes have emerged.
EPTC (3.4–4.4 kg/ha) + metribuzin (0.53–0.84 kg/ha)	EPTAM (800 g/L) + SENCOR 480 F (480 g/L)	4.25–5.5 L/ha (1.7–2.2 L/acre) + 1.1–1.75 L/ha (0.44–0.7 L/acre)	· PPI – Apply as a tank-mix in 220–330 L/ha (88–132 L/acre) water and incorporate immediately. · **Do NOT** use on muck soils. · **Do NOT** use on Belleisle or Tobique varieties. · **Do NOT** apply more than two times a year. · When growing new or potentially sensitive varieties (such as early maturing, red-skinned, Atlantic, Eramosa or Shepody) first use of SENCOR herbicide should be limited to a small test area to ensure risk or level of potential injury is acceptable to the grower prior to adoption as a general field practice.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
POTATOES (cont'd)			
Soil Applied Tank-Mix Options			
metribuzin (0.42–0.825 kg/ha) + linuron (0.768–1.8 kg/ha)	SENCOR 75 DF (75 WG) + LOROX L (480 g/L)	0.56–1.1 kg/ha (0.23–0.44 kg/acre) + 1.6–3.75 L/ha (0.64–1.5 L/acre)	· PRE – Apply after hilling and before emergence of the crop, or POST before weeds are 4 cm tall. · Use the lower rate on sandy soils. · Use the higher rate on late potatoes for season long control. · **Do NOT** use on muck soils. · **Do NOT** use on Belleisle and Tobique varieties. · When growing new or potentially sensitive varieties (such as early maturing, red-skinned, Atlantic, Eramosa or Shepody) first use of SENCOR herbicide on a potato variety should be limited to a small test area to ensure risk or level of potential injury is acceptable to the grower prior to adoption as a general field practice. · **Do NOT** harvest within 60 days of application.
Non-Selective Herbicides and Tank-Mix Options			
paraquat (0.55–0.85 kg/ha)	GRAMOXONE (200 g/L)	2.75–4.25 L/ha (1.1–1.7 L/acre)	· Apply in 300–550 L/ha (120–220 L/acre) water to emerged weeds. · Use on Netted Gem and Cherokee varieties before emergence. Apply on other varieties until 25%–30% of the crop has emerged but none of the tops should be over 5–8 cm in height. Temporary yellowing on the tops will occur. · **Do NOT** use on emerged potato plants in the evening, under cloudy conditions or when the plants are under moisture stress.
glufosinate ammonium (0.405–0.75 kg/ha)	IGNITE (150 g/L)	2.7–5 L/ha (1.08–2 L/acre)	· Apply in 110–330 L/ha (44–132 L/acre) of water at no later than ground crack of the crop. · Only emerged weeds will be controlled.
glufosinate ammonium (0.405–0.75 kg/ha) + metribuzin (0.55 kg/ha)	IGNITE (150 g/L) + SENCOR 480 F (480 g/L)	2.7–5 L/ha (1.08–2 L/acre) + 1.1 L/ha (0.44 L/acre)	· POST – Apply in 110–330 L/ha (44–132 L/acre) of water at no later than ground crack of the crop. · Only emerged weeds will be controlled. · **Do NOT** use SENCOR on muck soils or on Belleisle or Tobique varieties.
Postemergence Grass Herbicides			
fenoxaprop-p-ethyl (0.054 kg/ha)	EXCEL SUPER (80.5 g/L)	0.67 L/ha (0.27 L/acre)	· Apply when majority of annual grasses are in the 1–6 leaf stage or until volunteer corn is up to 25 cm tall. · **Do NOT** apply if rainfall is expected within 1 h after application. · Grasses emerging after application will not be controlled. · Preharvest interval is 35 days.
sethoxydim (0.14–0.5 kg/ha) surfactant/solvent (0.25–2 L/ha)	POAST ULTRA (450 g/L) + MERGE	0.32–1.1 L/ha (0.13–0.44 L/acre) + 0.25–2 L/ha (0.1–0.8 L/acre)	· For annual grass, use 0.32 L/ha (0.13 L/acre). Apply at the 1–6 leaf stage. · For volunteer grains, use 0.47 L/ha (0.19 L/acre). · For quackgrass, use 1.1 L/ha (0.44 L/acre). Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days in wide row crops. Use the high rate of MERGE for quackgrass. · Use 100–200 L/ha (40–80 L/acre) water. · **Do NOT** apply if rain is expected within 1 h after application. · **Do NOT** apply closer than 80 days to harvest.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
POTATOES (cont'd)			
Postemergence Grass Herbicides			
clethodim (0.03–0.09 kg/ha) + surfactant (0.5–1% v/v)	SELECT (240 g/L) + AMIGO SELECT (240 g/L) + ARROW (240 g/L)	0.125–0.38 L/ha (0.05–0.15 L/acre) + 5–10 L/1,000 L water	· Potatoes are tolerant at any growth stage. · For annual grasses and volunteer cereals, apply at the 2–6 leaf stage. · For quackgrass, apply at the 2–5 leaf stage at the higher rate. · **Do NOT** harvest for 60 days after application.
fluazifop-p-butyl (0.075–0.25 kg/ha)	VENTURE L (125 g/L)	0.6–2 L/ha (0.24–0.8 L/acre)	· Apply POST to actively growing grasses before tillering. · Apply at 0.6 L/ha (0.24 L/acre) at 2–5 leaf stage of volunteer corn. · Apply at 0.8 L/ha (0.32 L/acre) at 2–5 leaf stage of volunteer wheat and barley. · Apply at 1 L/ha (0.4 L/acre) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails). · Apply at 2 L/ha (0.8 L/acre) at 3–5 leaf stage of quackgrass and wirestem muhly. · Apply in a maximum volume of 300 L/ha (120 L/acre). · Thorough preplant tillage, fragmenting quackgrass rhizomes improves control. · **Do NOT** cultivate between rows until 5 days after application. · **Do NOT** apply closer than 45 days to harvest. · May be tank-mixed with SENCOR.
Postemergence Broadleaf Herbicides			
carfentrazone-ethyl (8.8–28.1 g/ha) + non-ionic surfactant (0.25% v/v)	AIM EC (240 g/L) + AGRAL 90 AIM EC (240 g/L) + AG-SURF	36.5–117 mL/ha (14.8–46.8 mL/acre) + 2.5 L/1,000 L	· Apply POST with a hooded sprayer between the rows. · Apply to actively growing weeds up to 10 cm tall. · Apply in a minimum of 100 L/ha (40 L/acre) water. · **Do NOT** apply closer than 7 days to harvest. · Apply **ONLY** once per growing season.
carfentrazone-ethyl (8.8–28.1 g/ha) + surfactant/solvent (0.1% v/v)	AIM EC (240 g/L) + MERGE	36.5–117 mL/ha (14.8–46.8 mL/acre) + 1 L/1,000 L	
Postemergence Grass and Broadleaf Herbicides			
rimsulfuron (15 g/ha) + non-ionic surfactant (0.2% v/v)	PRISM (25 DF) + AGRAL 90 PRISM (25 DF) + AG-SURF PRISM (25 SG) + AGRAL 90 PRISM (25 SG) + AG-SURF	60 g/ha (24 g/acre) + 2 L/1,000 L water	· Apply when quackgrass is at 3–6 leaf stage (less than 10 cm tall), annual grasses are at 1–6 leaf stage and redroot pigweed is in the 4–6 leaf stage. · Apply before potatoes initiate flowering. · Always add water soluble packages to clean water with the agitator running. · Apply in a minimum 100 L/ha (40 L/acre) of water. · **Do NOT** cultivate within 7–10 days before and after applying PRISM. · **Do NOT** apply within 30 days of harvest.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
POTATOES (cont'd)			
Postemergence Grass and Broadleaf Herbicides (cont'd)			
metribuzin (0.4–1.1 kg/ha)	SENCOR 480 F (480 g/L)	0.85–2.25 L/ha (0.34–0.9 L/acre)	· Apply soon after potatoes emerge and before weeds are 4 cm high. · Apply in the afternoon or early evening on sunny days. · **Do NOT** use on Belleisle or Tobique varieties. · When growing new or potentially sensitive varieties (such as early maturing, red-skinned, Atlantic, Eramosa or Shepody) first use of SENCOR herbicide on a potato variety should be limited to a small test area to ensure risk or level of potential injury is acceptable to the grower prior to adoption as a general field practice. · **Do NOT** harvest within 60 days of application. · **Do NOT** use on muck soil to avoid injury on subsequent crops.
rimsulfuron (15 g/ha) + metribuzin (210–281 g/ha) + non-ionic surfactant (0.2% v/v)	TITUS PRO (sold as a co-pack): PRISM (25 SG) + TRICOR (75 DF) + AGRAL 90	60 g/ha (24 g/acre) + 280–375 g/ha (113–152 g/acre) + 2 L/1,000 L	· Apply POST when potatoes are less than 10 cm high. · **Do NOT** apply after Atlantic, Eramosa, Shepody, red-skinned or any early maturing varieties have emerged. · Avoid application when the crop is under stress from poor growing conditions such as cool, wet and cloudy weather. · Spray before weeds are 4 cm high. · Use high rates of TRICOR for grasses and dense broadleaf weeds. · **Do NOT** harvest within 90 days after application. · Refer to precautionary statements for Prism 25 SG for additional notes.
	PRISM (25 SG) + TRICOR (75 DF) + AG-SURF		
Preharvest			
carfentrazone-ethyl (17.5–84 g/ha) + non-ionic surfactant (0.25% v/v)	AIM EC (240 g/L) + non-ionic surfactant	73–350 mL/ha (30–140 mL/acre) + 2.5 L/1,000 L	· Coverage of weed and crop foliage is essential for control. · Apply at a minimum water volume of 100 L/ha (40 L/acre). · Pre Harvest Interval (PHI) is 7 days. · If a second burndown application is required, use REGLONE DESSICANT at the rates listed below.
carfentrazone-ethyl (17.5–84 g/ha) + MERGE (0.1% v/v)	AIM EC (240 g/L) + MERGE	73–350 mL/ha (30–140 mL/acre) + 10 L/1,000 L	
diquat (0.3–0.84 kg/ha)	REGLONE DESICCANT (240 g/L)	1.25–3.5 L/ha (0.5–1.4 L/acre)	· Use 1.25–3.5 L/ha (0.5–1.4 L/acre) by ground and 1.7–2.3 L/ha (0.7–0.9 L/acre) for aerial applications. · Use a minimum of 550 L/ha (220 L/acre) of spray volume. · Use the higher rate for heavy canopy of crop and weeds. · A second application may be necessary 4–6 days after first application within the normal top killing time. · **Do NOT** harvest for at least 1 day after application. · **Do NOT** apply to drought stressed potatoes or if soil is water logged. · **Do NOT** apply if rain is expected within 15 minutes after application. · Refer to label for specific environmental precautions.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
RHUBARB			
Soil Applied Broadleaf Herbicides			
mesotrione (0.14 kg/ha)	CALLISTO (480 g/L)	0.30 L/ha (0.12 L/acre)	· Make **ONLY** 1 application per year. · **Do NOT** harvest within 42 days of application. · Apply in 200 L/ha (80 L/acre) water at 206–300 kPa. · **Do NOT** apply by air. · Apply to dormant (prior to spring greenup) rhubarb. Applications to rhubarb that is not dormant will result in crop injury. Rainfall or irrigation after application may increase the risk of injury to emerging rhubarb. · Repeated use in low pH soils may cause injury to rhubarb plants. Wait at least 18 months after the application in rhubarb before replanting rhubarb.
halosulfuron (25–51 g/ha)	SANDEA (72.6 WG)	35–70 g/ha (14–28 g/acre)	· Apply as a single application to dormant rhubarb · Use a minimum water volume of 140 L/ha (56 L/acre). · Rains greater than 2.5 cm within 5–7 days of application may cause temporary yellowing and delay development of crop. · **Do NOT** spray over top of plastic mulch. · **Do NOT** harvest within 60 days after application.
RUTABAGAS			
Site Preparation Before Planting – See Chapter 6, Preplant and Postharvest Weed Control, page 91.			
Soil Applied Grass and Broadleaf Herbicides			
napropamide (1.1–2.2 kg/ha)	DEVRINOL DF (50 DF)	2.2–4.4 kg/ha (0.9–1.8 kg/acre)	· PPI – Incorporate within 24 h of application. · Use the lower rate on sandy soils. · **Do NOT** apply to soils with over 10% organic matter. · Damage to subsequent cover crops can be reduced by tillage across the rows after harvest. · Shepherd's-purse and lady's-thumb may escape treatment at this rate. · Preharvest interval is 60 days.
	DEVRINOL DF-XT (50 DF-XT)		
s-metolachlor/ benoxacor (1.14–1.6 kg/ha)	DUAL II MAGNUM (915 g/L)	1.25–1.75 L/ha (0.5–0.7 L/acre)	· Apply PPI or PRE. PPI gives optimal control of yellow nutsedge; PRE gives optimal control of eastern black nightshade. · **Do NOT** use on muck, peat and high organic matter soils. · **Do NOT** use on soils with less than 1% organic matter. · Use the higher rate for heavier weed populations. · Apply by ground application equipment only.
trifluralin (0.6–1.155 kg/ha)	TREFLAN EC (480 g/L)	1.2–2.4 L/ha (0.48–0.96 L/acre)	· Apply PPI. Incorporate within 24 h of application. · **Do NOT** apply to peat or muck soils (greater than 15% organic matter). · **Do NOT** apply to soils with less than 2% organic matter. · **Do NOT** apply to fields spread with manure within the last 12 months. · **Do NOT** apply by air. · **Do NOT** apply on the same land for 2 consecutive years.
	RIVAL EC (500 g/L)	1.2–2.3 L/ha (0.48–0.92 L/acre)	
	BONANZA 480 (480 g/L)	1.7–2.3 L/ha (0.8–1.1 L/acre)	

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
RUTABAGAS (cont'd)			
Postemergence Grass Herbicides			
quizalofop-p-ethyl (0.036–0.07 kg/ha) + oil concentrate (0.5% v/v)	ASSURE II (96 g/L) + SURE-MIX	0.38–0.75 L/ha (0.15–0.3 L/acre) + 5 L/1,000 L	· Apply to emerged annual grasses and volunteer cereals in the 2 leaf to tillering stage, and volunteer corn and quackgrass in the 2–6 leaf stage. · Use the 0.38 L/ha (0.15 L/acre) rate for control of volunteer corn, volunteer cereals and green foxtail. · The 0.5 L/ha (0.2 L/acre) rate will suppress quackgrass and also control barnyard grass. · Use the 0.75 L/ha (0.3 L/acre) rate for control of quackgrass. · **Do NOT** harvest within 30 days of application.
	YUMA GL (96 g/L) + XA OIL CONCENTRATE		
fluazifop-p-butyl (0.075–0.25 kg/ha)	VENTURE L (125 g/L)	0.6–2 L/ha (0.24–0.8 L/acre)	· Apply POST to actively growing grasses before tillering. · Apply at 0.6 L/ha (0.24 L/acre) at 2–5 leaf stage of volunteer corn. · Apply at 0.8 L/ha (0.32 L/acre) at 2–5 leaf stage of volunteer wheat and barley. · Apply at 1 L/ha (0.4 L/acre) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails). · Apply at 2 L/ha (0.8 L/acre) at 3–5 leaf stage of quackgrass and wirestem muhly. Thorough preplant tillage will ensure more uniform emergence. Cultivate 7 days after treatment in wide row crops. · Apply in a maximum volume of 300 L/ha (120 L/acre). · Apply **ONLY** once per season. · **Do NOT** apply other herbicides within 3 days of application. · **Do NOT** apply if rain is expected within 2 h after application. · Preharvest interval is 45 days.
Postemergent Broadleaf Herbicides			
carfentrazone-ethyl (8.8–28.1 g/ha) + non-ionic surfactant (0.25% v/v)	AIM EC (240 g/L) + AGRAL 90	36.5–117 mL/ha (14.6–46.8 mL/acre) + 2.5 L/1,000 L	· Apply POST with a hooded sprayer between the rows. · Apply to actively growing weeds up to 10 cm tall. · Apply in a minimum of 100 L/ha (40 L/acre) water. · **Do NOT** apply closer than 1 day to harvest. · Apply **ONLY** once per growing season.
	AIM EC (240 g/L) + AG-SURF		
carfentrazone-ethyl (8.8–28.1 g/ha) + surfactant/solvent (0.1% v/v)	AIM EC (240 g/L) + MERGE	36.5–117 mL/ha (14.6–46.8 mL/acre) + 1 L/1,000 L	
clopyralid (0.2 kg/ha)	LONTREL 360 (360 g/L)	0.56 L/ha (0.22 L/acre)	· Apply POST when ragweed is 5–10 cm tall. · Make **ONLY** 1 application per year in 200–300 L/ha (80–120 L/acre) water. · **Do NOT** apply by air. · **Do NOT** apply if rain is expected within 4 h after application. · Preharvest interval is 83 days.
ethametsulfuron-methyl (0.011 kg/ha) + non-ionic surfactant (0.2% v/v)	MUSTER TOSS-N-GO (75%) + AGRAL 90	0.015 kg/ha (0.006 kg/acre) 2 L/1,000 L	· MUSTER can be used for control of wild mustard on Laurentian rutabagas from the cotyledon to 6 leaf stage. · Apply only once per year. · Pre-harvest interval of 45 days. · Apply in a minimum of 100 L/ha (40 L/acre) water.
	MUSTER TOSS-N-GO (75%) + AG-SURF		

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
SPECIALTY VEGETABLES: CHINESE BROCCOLI, RADISH AND CABBAGE, KOHLRABI, MUSTARD CABBAGE, FUZZY SQUASH, SNOW PEAS			
Site Preparation Before Planting – See Chapter 6, Preplant and Postharvest Weed Control, page 91.			
Soil Applied Grass and Broadleaf Herbicides			
napropamide (1.12–2.25 kg/ha)	DEVRINOL DF (50 DF) DEVRINOL DF-XT (50 DF-XT)	2.25–4.5 kg/ha (0.9–1.8 kg/acre)	· PRE or PREPLANT – For use **ONLY** on seeded Chinese broccoli, mustard, cabbage, Chinese radish, Chinese mustard cabbage, Chinese cabbage, transplanted Chinese cabbage and kohlrabi. · Use the lower rate on light soils (coarse textured to sandy and sandy loam). · **ONLY** 1 application per year. Ground application **ONLY**. · **Do NOT** apply closer than 60 days to harvest. · After harvest, soil should be worked (across rows if banded) to prevent injury to succeeding crops. · Small grains seeded in the fall may be stunted but not otherwise affected.
napropamide (1.5 kg/ha)	DEVRINOL DF (50 DF) DEVRINOL DF-XT (50 DF-XT)	3 kg/ha (1.2 kg/acre)	· PPI – For use on fuzzy squash transplants **ONLY**. · Requires rainfall or sufficient irrigation to wet the soil to a depth of 5–10 cm soon after application. · Some crop stunting may be observed but this should not affect yield.
s-metolachlor/ benoxacor (1.098–1.373 kg/ha)	DUAL II MAGNUM (915 g/L)	1.2–1.5 L/ha (0.48–0.6 L/ha)	· Apply to mustard green transplants **ONLY**. · Apply PRE or POST (weeds at the 2 leaf stage or less). · Apply **ONLY** once per year by ground application in a minimum of 150–300 L/ha (60–120 L/acre) water. · **Do NOT** harvest for 30 days after application. · Yield losses may occur when applied to transplanted mustard greens. · Control may be reduced in areas of high weed density.
imazethapyr (0.075 kg/ha)	PURSUIT (240 g/L)	0.312 L/ha (0.125 L/acre)	· PRE and PPI – For use on snow peas **ONLY**. · Apply **ONLY** once per year in 100–400 L/ha (40–160 L/acre). · **Do NOT** apply closer than 60 days to harvest.
Postemergence Grass Herbicides			
clethodim (46–91 g/ha) + surfactant (0.5–1% v/v)	CENTURION (240 g/L) + AMIGO SELECT (240 g/L) + AMIGO	0.19–0.38 L/ha (0.08–0.15 L/acre) + 5–10 L/1,000 L	· For the control of annual grasses and quackgrass. · See label for detailed information on rates to control all annual grasses. · Apply using ground equipment. · Apply in a minimum of 100 L/ha (44 L/acre) water for SELECT and 200 L/ha (80 L/acre) water for CENTURION. · Apply when grassy weeds are at 2–6 leaf stage. · **Do NOT** exceed 2 applications per year and 0.38 L/ha (0.15 L/acre). · **Do NOT** apply within 30 days of harvest.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
SPECIALTY VEGETABLES: CHINESE BROCCOLI, RADISH AND CABBAGE, KOHLRABI, MUSTARD CABBAGE, FUZZY SQUASH, SNOW PEAS (cont'd)			
Postemergence Grass Herbicides (cont'd)			
sethoxydim (0.14–0.5 kg/ha) + surfactant/solvent (0.25–2 L/ha)	POAST ULTRA (450 g/L) + MERGE	0.32–1.1 L/ha (0.13–0.44 L/acre) + 0.25–2 L/ha (0.1–0.8 L/acre)	· For use **ONLY** on Chinese broccoli, Chinese cabbage, kohlrabi, mustard cabbage and Chinese radish and snow peas. · Apply using 100–200 L/ha (40–80 L/acre) water volume. · For annual grass, use 0.32 L/ha (0.13 L/acre). Apply at the 1–6 leaf stage. · For volunteer grains, use 0.47 L/ha (0.19 L/acre). · For quackgrass, use 1.1 L/ha (0.44 L/acre). Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days in wide row crops. Use the high rate of MERGE for quackgrass. · Use the 0.32 L/ha (0.13 L/acre) rate **ONLY** for snow peas. · **Do NOT** apply if rain is expected within 1 h after application. · **Do NOT** apply closer than 30 days to harvest.
Postemergent Broadleaf Herbicides			
carfentrazone-ethyl (8.8–28.1 g/ha) + non-ionic surfactant (0.25% v/v)	AIM EC (240 g/L) + AG-SURF AIM EC (240 g/L) + AGRAL 90	36.5–117 mL/ha (14.6–46.8 mL/acre) + 2.5 L/1,000 L	· Apply POST with a hooded sprayer between the rows. · Apply to actively growing weeds up to 10 cm tall. · Apply in a minimum of 100 L/ha (40 L/acre) water. · **Do NOT** apply closer than 1 day to harvest. · Apply **ONLY** once per growing season.
carfentrazone-ethyl (8.8–28.1 g/ha) + or surfactant/solvent (0.1% v/v)	AIM EC (240 g/L) + MERGE	36.5–117 mL/ha (14.6–46.8 mL/acre) + 1 L/1,000 L	
bentazon (0.84 kg/ha) + oil concentrate (1–2 L/ha)	BASAGRAN (480 g/L) + ASSIST	1.75 L/ha (0.7 L/acre) + 1–2 L/ha (0.4–0.8 L/acre)	· For snow peas **ONLY**. · Apply after the crop is at the 3 leaf stage when weeds are small and actively growing. · Use **ONLY** 1 application per year. · Apply in 300 L water/ha (120 L/acre). · **Do NOT** apply closer than 30 days to harvest.
clopyralid (0.20 kg/ha)	LONTREL 360 (360 g/L)	0.56 L/ha (0.2 L/acre)	· For use **ONLY** on nappa cabbage, Chinese radish, mustard cabbage, and Chinese broccoli. · Treat when weeds are young and actively growing. · Apply post planting as a ground application in 300 L/ha (120 L/acre) water. · Use **ONLY** 1 application per year. · **Do NOT** apply closer than 30 days to harvest. · Weeds that emerge after treatment will not be controlled.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
SPINACH			
Site Preparation Before Planting – See Chapter 6, Preplant & Postharvest Weed Control, page 91.			
Postemergence Grass Herbicides			
sethoxydim (0.14–0.5 kg/ha) + surfactant/solvent (0.25–2 L/ha)	POAST ULTRA (450 g/L) + MERGE	0.32–1.1 L/ha (0.13–0.44 L/acre) + 0.25–2 L/ha (0.1–0.8 L/acre)	· Apply to actively growing grasses. One application per year. · For annual grass, use 0.32 L/ha (0.13 L/acre). Apply at the 1–6 leaf stage (2–5 is optimum). · For volunteer grains, use 0.47 L/ha (0.19 L/acre). Apply at the 1–6 leaf stage (2–5 is optimum). · For quackgrass, use 1.1 L/ha. Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days in wide row crops. Use the high rate of MERGE for quackgrass. · Grasses emerging after application will not be controlled. · Use 100–200 L/ha (40–80 L/acre) water. · Spray tips angled forward 45° will give better coverage. · **Do NOT** use flood jet or hollow cone nozzles. · **Do NOT** apply if rain is expected within 1 h after application. · Preharvest interval is 15 days.
clethodim (0.03–0.046 L/ha) + surfactant (0.5% v/v)	SELECT (240 g/L) + AMIGO	0.125–0.19 L/ha (0.05–0.08 L/acre) + 5 L/1,000 L	· Apply using ground equipment. · Apply when grassy weeds are in the 2–6 leaf stage. · **Do NOT** exceed two applications per year. · Allow for 14 days between applications. · **Do NOT** harvest for 14 days after application. · See label for detailed information on rates to control all annual grasses.
Postemergence Broadleaf Herbicides			
carfentrazone-ethyl (8.8–28.1 g/ha) + non-ionic surfactant (0.25% v/v)	AIM EC (240 g/L) + AGRAL 90	36.5–117 mL/ha (14.6–46.8 mL/acre) + 2.5 L/1,000 L	· Apply POST with a hooded sprayer between the rows. · Apply to actively growing weeds up to 10 cm tall. · Apply in a minimum of 100 L/ha (40 L/acre) water. · **Do NOT** apply closer than 1 day to harvest. · Apply **ONLY** once per growing season.
	AIM EC (240 g/L) + AG-SURF		
carfentrazone-ethyl (8.8–28.1 g/ha) + surfactant/solvent (0.1% v/v)	AIM EC (240 g/L) + MERGE	36.5–117 mL/ha (14.6–46.8 mL/acre) + 1 L/1,000 L	

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
SUGAR BEETS (PROCESSING)			
Caution about Herbicide Residues – Sugar beets are one of the most sensitive crops to herbicide residues from the previous year's crop. They are particularly sensitive to residues from many of the Group 2 herbicides, including PURSUIT, BROADSTRIKE, CLASSIC and PEAK. Low soil pH (below 6.0) or high soil pH (above 7.5) can be a factor to delay the breakdown of these herbicides, increasing crop injury in rotational crops. Please see Table 4–4. Herbicide Crop Rotation and Soil pH Restrictions – Field Crops, page 74, as well as product labels and your herbicide and sugar company representatives for more details on your situation.			
Site Preparation Before Planting – See Chapter 6, Preplant & Postharvest Weed Control, page 91.			
Soil Applied Broadleaf Herbicides			
pyrazon (3.55–4.41 kg/ha)	PYRAMIN FL (430 g/L)	8.25–10.25 L/ha (3.3–4.1 L/acre)	· Apply PPI or PRE. · **Do NOT** incorporate more than 5 cm deep. · **Do NOT** apply to soils with less than 3% organic matter.
Soil Applied Grass and Broadleaf Herbicides			
ethofumesate (1.54–3.96 kg/ha)	NORTRON SC (480 g/L)	3.2–8.25 L/ha (1.28–3.3 L/acre)	· Apply PPI or PRE as a ground application no more than **ONLY** once per season, in 110–560 L/ha (44–224 L/acre) water. **Do NOT** incorporate more than 5 cm deep. · Use **ONLY** on mineral soils. · Use the lower rate on soils with less than 3% organic matter. · **Do NOT** rotate to other crops for 12 months.
Soil Applied Tank-Mix Option			
pyrazon (2.26 kg/ha) + ethofumesate (1.75 kg/ha)	PYRAMIN FL (430 g/L) + NORTRON SC (480 g/L)	5.25 L/ha (2.1 L/acre) + 3.65 L/ha (1.46 L/acre)	· PRE – Apply only once per year through ground application in 110–560 L/ha 44–224 L/acre) water. · **Do NOT** apply to soil with less than 3% organic matter. **Do NOT** use on sandy soils. · Use **ONLY** on mineral soils. · **Do NOT** rotate to crops other than sugar beets for 12 months.
Postemergence Grass Herbicides			
quizalofop-p-ethyl (0.036–0.072 kg/ha) + oil concentrate (0.5% v/v)	ASSURE II (96 g/L) + SURE-MIX YUMA GL (96 g/L) + XA OIL CONCENTRATE	0.38–0.75 L/ha (0.15–0.30 L/acre) + 5 L/1,000 L water	· Apply POST when annual grasses and volunteer cereals are in the 2 leaf to tillering stage and volunteer corn and quackgrass are in the 2–6 leaf stages. · Apply before the crop canopy closes to maximize spray coverage. · Use the 0.38 L/ha (0.15 L/acre) rate for annual grasses and volunteer cereals. · Use the 0.75 L/ha (0.30 L/acre) rate for quackgrass. · Use a second application of 0.38 L/ha (0.15 L/acre) to control late emerging weeds. · **Do NOT** exceed an accumulative seasonal use rate of 0.75 L/ha (0.30 L/acre). · **Do NOT** use flood jet nozzles. · **Do NOT** apply if rain is expected within 1 h after application. · Preharvest interval is 80 days.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
SUGAR BEETS (PROCESSING) (cont'd)			
Postemergence Grass Herbicides (cont'd)			
sethoxydim (0.14–0.5 kg/ha) + surfactant/solvent (0.25–2 L/ha)	POAST ULTRA (450 g/L) + MERGE	0.32–1.1 L/ha (0.13–0.44 L/acre) + 0.25–2 L/ha (0.1–0.8 L/acre)	· For annual grass, use 0.32 L/ha (0.13 L/acre). Apply at the 1–6 leaf stage (2–5 is optimum). · For volunteer grains, use 0.47 L/ha (0.19 L/acre). Apply at the 1–6 leaf stage (2–5 is optimum). · For quackgrass, use 1.1 L/ha (0.44 L/acre). Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days in wide row crops. Use the high rate of MERGE for quackgrass. · Use 100–200 L/ha (40–80 L/acre) water. · Grasses emerging after application will not be controlled. · **Do NOT** graze treated crop. · Spray tips angled forward 45° will give better coverage. · **Do NOT** use flood jet or hollow cone nozzles. · **Do NOT** apply if rain is expected within 1 hr after application. · **Do NOT** apply herbicides other than LONTREL 360 within 4 days of application. · **Do NOT** apply if rain is expected within 1 hour after application. · Preharvest interval is 85 days.
Postemergence Broadleaf Herbicides			
carfentrazone-ethyl (8.8–28.1 g/ha) + non-ionic surfactant (0.25% v/v)	AIM EC (240 g/L) + AGRAL 90 AIM EC (240 g/L) + AG-SURF	36.5–117 mL/ha (14.6–46.8 mL/acre) 2.5 L/1,000 L	· Apply POST with a hooded sprayer between the rows. · Apply to actively growing weeds up to 10 cm tall. · Apply in a minimum of 100 L/ha (40 L/acre) water. · **Do NOT** apply closer than 1 day to harvest. · Apply **ONLY** once per growing season.
carfentrazone-ethyl (8.8–28.1 g/ha) + surfactant/solvent (0.1% v/v)	AIM EC (240 g/L) + MERGE	36.5–117 mL/ha (14.6–46.8 mL/acre) + 1 L/1,000 L	
clopyralid	LONTREL 360 (360 g/L)	Consult label and your processor for application rates.	· Apply POST when sugar beets are in the cotyledon to 8 leaf stage. · Preharvest interval is 90 days.
pyrazon (3.55 kg/ha) + surfactant (0.25% v/v)	PYRAMIN FL (430 g/L) + CITOWETT PLUS	8.25 L/ha (3.3 L/acre) + 2.5 L/1,000 L	· Apply POST when first true leaf of sugar beets is at least 2.5 cm long. · **Do NOT** apply when beets are in the cotyledon stage. · Apply before the weeds have 3 true leaves. · **Do NOT** use on soils with less than 3% organic matter. · Avoid hot temperatures. · Apply using a minimum of 300 L/ha (120 L/acre) of water. · **Do NOT** use any other oils or surfactants.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
SUGAR BEETS (PROCESSING) (cont'd)			
Postemergence Broadleaf Herbicides (cont'd)			
triflusulfuron-methyl (17.5–35 g/ha) + non-ionic surfactant (0.25% v/v)	UPBEET (50 DF) + AGRAL 90	35–70 g/ha (14–28 g/acre) + 2.5 L/1,000 L water	· Apply POST when sugar beets are actively growing. · Yellowing of the crop may occur, but sugar beets will recover. · Make 2 applications 5–10 days apart when velvetleaf has fewer than 2 leaves. · Use the higher rate for larger weeds and heavy weed populations. · **Do NOT** use more than 100 g/ha (40 g/acre) in a season. · **Do NOT** apply under extreme temperatures or drought conditions. · **Do NOT** spray if rainfall is expected within 6 h. · Preharvest interval is 60 days.
	UPBEET (50 DF) + AG-SURF		
	UPBEET (50 DF) + CITOWETT PLUS		
triflusulfuron-methyl (17.5–35 g/ha) + adjuvant (0.25% v/v)	UPBEET (50 DF) + SURE-MIX		
Postemergence Grass and Broadleaf Herbicides			
desmedipham/ phenmedipham	BETAMIX B EC ((1:1) 153 g/L)	Consult label and your processor for application rates.	· Apply POST when sugar beets have at least 2 true leaves. · Apply before the weeds have 4 true leaves (before 2 true leaves is optimum). · Wait a minimum of 7 days before making a second full rate application. · Consult label for split (reduced rate) applications. · **Do NOT** spray in excess of 16.5 L/ha (6.7 L/acre) of BETAMIX B per year. · **Do NOT** spray under extreme temperature or drought conditions. · **Do NOT** spray if dew is present. · Yellowing of the crop may occur, but sugar beets will recover. · **Do NOT** spray if rainfall is expected within 6 h. · Preharvest interval is 60 days.
s-metolachlor/ benoxacor (1.14–1.6 kg/ha)	DUAL II MAGNUM (915 g/L)	1.25–1.75 L/ha (0.5–0.7 L/acre)	· Apply postemergent to sugarbeets between cotyledon to the 4 leaf stage and before weed emergence. · **Do NOT** apply more than 1 application per season. · Preharvest interval is 120 days. · **Do NOT** feed sugar beet tops to livestock. · Apply by ground equipment **ONLY.**

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
SUGAR BEETS (PROCESSING) (cont'd)			
Postemergence Tank-Mix Option			
triflusulfuron-methyl + desmedipham/ phenmedipham	UPBEET (50 DF) + BETAMIX B ((1:1) 150 g/L)	Consult label and your processor for application rates.	· Apply POST when sugar beets are actively growing. · Yellowing of the crop may occur, but sugar beets will recover. · Make 2 applications 5–10 days apart, or as weeds emerge, to weeds with fewer than 4 true leaves. Best control is obtained if weeds have less than 2 leaves. · Use the higher rate for larger weeds and heavy weed populations. · If velvetleaf is the predominant weed, use of UPBEET alone with an adjuvant is preferable. · **Do NOT** use an adjuvant with this tank-mix. · **Do NOT** use more than 100 g/ha (40 g/acre) in a season. · **Do NOT** apply under extreme temperature or drought conditions. · **Do NOT** spray if dew is present. · **Do NOT** spray if rainfall is expected within 6 h. · Preharvest interval is 60 days.
Glyphosate Tolerant ("Roundup Ready") Varieties Only			
glyphsosate (0.45–0.9 kg/ha)	ROUNDUP ULTRA2 (540 g/L)	0.83–1.67 L/ha (0.332–0.67 L/acre)	· Use **ONLY** on pedigreed (certified) sugarbeet seed designated as glyphosate tolerant (i.e., "Roundup Ready"). · Apply to emerged weeds up to 15 cm in height. · A maximum of 4 applications may be applied to glyphosate tolerant sugarbeets in 1 season. Allow a minimum of 10 days between applications. · **Do NOT** harvest sugarbeets within 30 days of the final glyphosate application.
	ROUNDUP WEATHERMAX (540 g/L)		

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
SWEET POTATOES			
Site Preparation Before Planting – See Chapter 6, Preplant & Postharvest Weed Control, page 91.			
Soil Applied Grass and Broadleaf Herbicides			
flumioxazin (0.054 kg/ha)	CHATEAU WDG (51.1%)	0.105 kg/ha (0.042 kg/acre)	· Significant crop injury may occur from applications made to poorly drained soils and/or applications made under cool, wet conditions. · Severe crop injury will result when soils are flooded following applications of CHATEAU WDG. Treated soil that is splashed onto newly emerged crops may result in temporary crop injury. · **Do NOT** apply more than 105 g/ha (42 g/acre) during a single growing season. · Apply prior to transplanting. **Do NOT** apply after sweet potato slips have been transplanted. · **Do NOT** use on any sweet potato variety other than Beauregard, unless user has tested CHATEAU WDG on the other variety and has found crop tolerance acceptable. · **Do NOT** apply on soils with >5% OM, or fine textured soils.
clomazone (0.558 kg/ha)	COMMAND 360 ME (360 g/L)	1.55 L/ha (0.62 L/acre)	· Apply as a single application post transplant surface applied to the crop and prior to weed emergence. · **Do NOT** incorporate. · Apply in a minimum of 95 L/ha (38 L/acre) of water. · **Do NOT** apply closer than 95 days to harvest.
chlorthal dimethyl (6.75–11.625 kg/ha)	DACTHAL W-75 (75 WP)	9–15.5 kg/ha (3.6–6.2 kg/acre)	· Apply at a rate of 9–13.5 kg/ha (3.6–5.4 kg/acre) on light sand or sandy loam soils. · Apply at a rate of 11–15.5 kg/ha (4.4–6.2 kg/acre) on medium silt loam soils. · **Do NOT** use on muck soils. · Apply in at least 225 L/ha (90 L/acre) of water. · Apply directly over transplants, preemergence to weeds. · If weeds have emerged, cleanly cultivate the soil before application. · Rainfall or irrigation (about 1 cm) is necessary for activation.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
SWEET POTATOES (cont'd)			
Postemergence Broadleaf Herbicides			
carfentrazone-ethyl (8.8–28.1 g/ha) + non-ionic surfactant (0.25% v/v)	AIM EC (240 g/L) + AGRAL 90	36.5–117 mL/ha (14.6–46.8 mL/acre) + 2.5 L/1,000 L	· Apply POST with a hooded sprayer between the rows. · Apply to actively growing weeds up to 10 cm tall. · Apply in a minimum of 100 L/ha (40 L/acre) water. · **Do NOT** apply closer than 1 day to harvest. · Apply **ONLY** once per growing season.
	AIM EC (240 g/L) + AG-SURF		
carfentrazone-ethyl (8.8–28.1 g/ha) + surfactant/solvent (0.1% v/v)	AIM EC (240 g/L) + MERGE	36.5–117 mL/ha (14.6–46.8 mL/acre) + 1 L/1,000 L	
Postemergence Grass Herbicides			
sethoxydim (0.14–0.5 kg/ha) + surfactant/solvent (0.25–2 L/ha)	POAST ULTRA (450 g/L) + MERGE	0.32–1.1 L/ha (0.13–0.44 L/acre) + 0.25–2.0 L/ha (0.1–0.8 L/acre)	· Apply using 100–200 L/ha (40–80 L/acre) water volume. · For annual grass, use 0.32 L/ha (0.13 L/acre). Apply at the 1–6 leaf stage. · For volunteer grains, use 0.47 L/ha (0.19 L/acre. · For quackgrass, use 1.1 L/ha (0.44 L/acre). Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days in wide row crops. Use the high rate of MERGE for quackgrass. · **Do NOT** apply if rain is expected within 1 h after application. · **Do NOT** apply closer than 30 days to harvest.
Postemergence Grass and Broadleaf Herbicides			
s-metolachlor/ benoxacor (1.14–1.6 kg/ha)	DUAL II MAGNUM (915 g/L)	1.25–1.75 L/ha (0.5–0.7 L/acre)	· Apply as an early post-emergent application 2–5 days after transplanting. · Pre-harvest interval is 105 days. · Varieties differ in their sensitivity. · Test DUAL II MAGNUM on a small area of all new varieties for acceptable tolerance.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
TOMATOES (TRANSPLANTED)			
Weed control in tomatoes usually consists of a combination of herbicide weed control and cultivation. Crop rotation is also beneficial in the control of weeds. Cultivation should be shallow to prevent bringing untreated soil to the surface, which may result in another flush of weeds. When tomatoes are grown on raised beds and beds are reshaped during the course of the season, it may be necessary or useful to apply another herbicide treatment to areas between the rows to prevent a new weed infestation from interfering with harvesting. Do not exceed the total label rate per season of any herbicide applied more than once per year. Band treatment of herbicides over the row will reduce the cost by one-half to two-thirds depending on the width of the band compared to the row spacing. Shallow inter-row cultivation will be required for weed control between the rows. Perennial weeds may be partially controlled by cultivation. Controlling perennial weeds in crops other than tomatoes when grown in rotation is the best approach to control. Perennials are easily spread with cultivators or tillage equipment. Till areas of perennial weeds last. Machinery sanitation is important when moving between fields.			
Site Preparation Before Planting – See Chapter 6, Preplant & Postharvest Weed Control, page 91.			
Apply all treatments in 150–300 L/ha (60–120 L/acre) water unless otherwise specified.			
Soil Applied Broadleaf Herbicides			
halosulfuron (25–51 g/ha)	SANDEA (72.6 WG)	35–70 g/ha (14–28 g/acre)	· **Do NOT** apply to direct seeded tomatoes. · Avoid application under stressful conditions. · **Do NOT** use on coarse soils. · **Do NOT** harvest within 60 days of application.
Soil Applied Grass and Broadleaf Herbicides			
s-metolachlor/metribuzin (1,443–1,943 g/ha)	BOUNDARY LQD (628 g/L + 149 g/L)	1.85–2.5 L/ha (0.74–1 L/acre)	· **Do NOT** apply to direct seeded tomatoes. · Avoid application under stressful conditions. · **Do NOT** use on coarse soils. · **Do NOT** harvest within 60 days of application.
napropamide (1.12–2.25 kg/ha)	DEVRINOL DF (50 DF) DEVRINOL DF-XT (50 DF-XT)	2.25–4.5 kg/ha (0.9–1.8 kg/acre)	· Apply PPI. Incorporate within 24 hr of application. Incorporate shallowly to maintain spatial separation between herbicide treated zone and developing transplant roots. · Registered for use on field seeded and transplanted tomatoes. · Use the lower rates on light textured soils. · **Do NOT** apply to soils with over 10% organic matter. · Damage to subsequent cover crops can be reduced by tillage across the rows after harvest. Small grains seeded in the fall may be stunted but not otherwise affected.
s-metolachlor/ benoxacor (1.14–1.6 kg/ha)	DUAL II MAGNUM (915 g/L)	1.25–1.75 L/ha (0.5–0.7 L/acre)	· Apply PPI. Incorporate shallowly to maintain spatial separation between herbicide treated zone and developing tomato roots. · **Do NOT** use on muck, peat, high organic matter soils. · **Do NOT** use on soils with less than 1% organic matter. · Use the higher rate for heavier weed populations, eastern black nightshade and yellow nutsedge. · Apply in 150–300 L/ha (60–120 L/acre) water. Make **ONLY** 1 application per year. · **Do NOT** apply on direct-seeded tomatoes. · Since not all tomato varieties have been tested for tolerance to Dual II Magnum, the first use should be limited to a small area of each variety to confirm tolerance prior to adoption as a general field practice. · **Do NOT** harvest within 60 days of application.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
TOMATOES (TRANSPLANTED) (cont'd)			
Soil Applied Tank-Mix Options			
s-metolachlor/ benoxacor (1.14–1.6 kg/ha) + metribuzin (0.24–0.7 kg/ha)	DUAL II MAGNUM (915 g/L) + SENCOR 480 F (480 g/L)	1.25–1.75 L/ha (0.5–0.7 L/acre) + 0.5–1.4 L/ha (0.2–0.7 L/acre)	· Apply PPI. Incorporate shallowly to maintain spatial separation between herbicide treated zone and developing transplant roots. · **Do NOT** use on muck, peat, or high organic matter soils. · **Do NOT** use on soils with less than 2% organic matter. · Use the higher rate of DUAL II MAGNUM for heavier weed populations, eastern black nightshade and yellow nutsedge. · Use lower rate of metribuzin and repeat applications of metribuzin when the crop is established as described under postemergence application of metribuzin. · Refer to the product labels regarding application rates for different soil types. · **Do NOT** exceed total maximum rate of metribuzin recommended on the label for your soil type. · **Do NOT** harvest within 60 days of application.
trifluralin (0.6–1.15 kg/ha)	TREFLAN EC (480 g/L)	1.2–2.4 L/ha (0.48–0.96 L/acre)	· Use **ONLY** on transplant tomatoes grown for processing. · Apply PPI. Incorporate within 24 h of application. Incorporate shallowly to maintain spatial separation between herbicide treated zone and developing transplant roots. · Cool, wet weather may delay transplant establishment but yield is not usually affected. · **Do NOT** apply to peat or muck soils (greater than 15% organic matter). · **Do NOT** apply to soils with less than 2% organic matter. · **Do NOT** apply to fields spread with manure within the last 12 months. · **Do NOT** apply by air.
	RIVAL EC (500 g/L)	1.2–2.3 L/ha (0.48–0.92 L/acre)	
	BONANZA 480 (480 g/L)	1.25–2.3 L/ha (0.5–0.92 L/acre)	
trifluralin (0.6–1.15 kg/ha) + metribuzin (0.24–0.7 kg/ha)	TREFLAN EC (480 g/L) + SENCOR 480 F (480 g/L)	1.2–2.4 L/ha (0.48–0.96 L/acre) + 0.5–1.4 L/ha (0.2–0.56 L/acre)	· Apply PPI. Incorporate within 24 h of application. Incorporate shallowly to maintain spatial separation between herbicide treated zone and developing transplant roots. · **Do NOT** apply to peat or muck soils (greater than 15% organic matter). · **Do NOT** apply to soils with less than 2% organic matter. · **Do NOT** apply to fields spread with manure within the last 12 months. · Use lower rates on sandy soils or soils with low organic matter. · Use lower rate of metribuzin and repeat applications of metribuzin when crop is established as described under postemergence application of metribuzin. · **Do NOT** exceed total maximum rate of metribuzin recommended on the label for your soil type. · Cool, wet weather may delay establishment, but yield is not usually affected.
	RIVAL EC (500 g/L) + SENCOR 480 F (480 g/L)	1.2–2.3 L/ha (0.48–0.92 L/acre) + 0.5–1.4 L/ha (0.2–0.56 L/acre)	
	BONANZA 480 (480 g/L) + SENCOR 480 F (480 g/L)	1.25–2.3 L/ha (0.5–0.92 L/acre) + 0.5–1.4 L/ha (0.2–0.56 L/acre)	
Postemergence Grass Herbicides			
fenoxaprop-p-ethyl (0.054 kg/ha)	EXCEL SUPER (80.5 g/L)	0.67 L/ha (0.27 L/acre)	· Apply POST when annual grasses are in the 1–6 leaf stage and volunteer corn is up to 25 cm tall. · Annual grasses emerging after application will not be controlled. · **Do NOT** apply other herbicides within 4 days of application. · **Do NOT** apply by air. · **Do NOT** use flood jet nozzles or controlled droplet application equipment. · Spray tips angled forward 45° will give better coverage. · **Do NOT** apply if rain is expected within 1 h after application. · Preharvest interval is 55 days.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
TOMATOES (TRANSPLANTED) (cont'd)			
Postemergence Grass Herbicides(cont'd)			
sethoxydim (0.14–0.5 kg/ha) surfactant/solvent (0.25–2 L/ha)	POAST ULTRA (450 g/L) + MERGE	0.32–1.1 L/ha (0.13–0.44 L/acre) + 0.25–2 L/ha (0.1–0.8 L/acre)	· For annual grass, use 0.32 L/ha (0.13 L/acre). Apply at the 1–6 leaf stage (2–5 is optimum). · For volunteer grains, use 0.47 L/ha (0.19 L/acre). Apply at the 1–6 leaf stage (2–5 is optimum). · For quackgrass, use 1.1 L/ha (0.44 L/acre). Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days in wide row crops. Use the high rate of MERGE for quackgrass. · Use 100–200 L/ha (40–80 L/acre) water. · Grasses emerging after application will not be controlled. · **Do NOT** apply any other chemicals within 4 days of POAST ULTRA application. · Spray tips angled forward 45° will give better coverage. · **Do NOT** use flood jet or hollow cone nozzles. · **Do NOT** apply if rain is expected within 1 h after application. · Preharvest interval is 60 days.
fluazifop-p-butyl (0.075–0.25 kg/ha)	VENTURE L (125 g/L)	0.6–2 L/ha (0.24–0.8 L/acre)	· Apply POST to actively growing grasses before tillering. · Apply at 0.6 L/ha (0.24 L/acre) at 2–5 leaf stage of volunteer corn. · Apply at 0.8 L/ha (0.32 L/acre) at 2–5 leaf stage of volunteer wheat and barley. · Apply at 1 L/ha (0.4 L/acre) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails). · Apply at 2 L/ha (0.8 L/acre) at 3–5 leaf stage of quackgrass and wirestem muhly. Thorough preplant tillage, fragmenting quackgrass rhizomes improves control. · Apply in a maximum volume of 300 L/ha (120 L/acre). · **Do NOT** cultivate for 5 days after application. · **Do NOT** apply other herbicides within 3 days of application. · **Do NOT** apply if rain is expected within 2 h after application. · Preharvest interval is 60 days.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
TOMATOES (TRANSPLANTED) (cont'd)			
Postemergent Broadleaf Herbicides			
carfentrazone-ethyl (8.8–28.1 g/ha) + non-ionic surfactant (0.25% v/v)	AIM EC (240 g/L) + AGRAL 90 AIM EC (240 g/L) + AG-SURF	36.5–117 mL/ha (14.6–4 mL/acre) + 2.5 L/1,000 L	· Apply POST with a hooded sprayer between the rows. · Apply to actively growing weeds up to 10 cm tall. · Apply in a minimum of 100 L/ha (40 L/acre) water. · **Do NOT** apply closer than 1 day to harvest. · Apply **ONLY** once per growing season.
carfentrazone-ethyl (8.8–28.1 g/ha) + surfactant/solvent (0.1% v/v)	AIM EC (240 g/L) + MERGE	36.5–117 mL/ha (14.6–4 mL/acre) + 1 L/1,000 L	
thifensulfuron methyl (4.1–6.0 g/ha) + non-ionic surfactant (0.2% v/v)	PINNACLE SG (50%) + AGRAL 90	8.25–12 g/ha (3.3–4.8 g/acre) + 2 L/1,000 L	· Apply 3 weeks after transplanting to weeds less than 10 cm tall. · Add PINNACLE to the spray tank and agitate, then add AGRAL 90. · **Do NOT** apply in less than 100 L/ha (40 L/acre) water. · **Do NOT** apply if rain is expected within several hours. · Apply **ONLY** once per year. · **Do NOT** apply to tomatoes that are stressed. · **Do NOT** apply within 45 days of harvest.
halosulfuron (25–51 g/ha) + non-ionic surfactant (0.2% v/v)	SANDEA (72.6 WG) + non-ionic surfactant	35–70 g/ha (14–28 g/acre) 2 L/1,000 L	· Apply POST to tomatoes 14 days after transplanting through to first bloom. · To maximize control of nutsedge, a second spot application on emerged nutsedge may be necessary. · Maximum of two applications per season with a minimum of 21 days between applications. Do not apply more than 70 g/ha (28 g/acre) per season. · Use a minimum water volume of 190 L/ha (76 L/acre). · Spraying over top of plastic mulch may result in significant injury. · **Do NOT** harvest within 30 days after application.
Postemergent Grass and Broadleaf Herbicides			
rimsulfuron (15–35 g/ha) + non-ionic surfactant (0.2% v/v)	PRISM (25 DF) + AGRAL 90 PRISM (25 DF) + AG-SURF PRISM (25 SG) + AGRAL 90 PRISM (25 SG) + AG-SURF	60–140 g/ha (24–57 g/acre) + 2 L/1,000 L water	· Use the 140 g/ha (57 g/acre) rate for control of triazine resistant lamb's-quarters, hairy nightshade plus other broadleaf weeds listed. · Apply POST when hairy nightshade is up to the 4 leaf stage, quackgrass is in the 3–6 leaf stage (less than 10 cm tall), annual grasses are in the 1–6 leaf stage and redroot pigweed is at the 4–6 leaf stage. · Apply **ONLY** once per year. · **Do NOT** apply if rainfall is expected within 2 h of application. · Preharvest interval is 30 days. · May be used on processing and fresh market tomatoes. · Apply at least 21 days after transplanting the crop.

TABLE 13–2. Herbicide Treatment Rates for Vegetable Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
TOMATOES (TRANSPLANTED) (cont'd)			
Postemergent Grass and Broadleaf Herbicides (cont'd)			
metribuzin (0.15–0.83 kg/ha)	SENCOR DF (75 DF) TRICOR 75 DF (75%)	0.2–1.1 kg/ha (0.08–0.44 kg/acre)	· May be used on processing and fresh market tomatoes. · Apply POST at least 3 weeks after transplanting before weeds exceed 4 cm in height. · When making mulitple applications, apply at a rate of 0.2 kg/ha (0.08 kg/acre). · **Do NOT** apply more than 4 times a year. · Direct spray to bottom one-third of tomato plants to reduce risk of crop injury. · **Do NOT** apply when crop is under stress due to cool, wet, cloudy weather or excessively hot temperatures. · **Do NOT** use on muck soils. · **Do NOT** use on soils with less than 2% organic matter. · Use lower rates on sandy soils, higher rates on clay soils. · Preharvest interval for single applications is 60 days. Preharvest interval for smaller multiple applications is 30 days from the last application.
metribuzin (0.14 kg/ha)	SENCOR 480 F (480 g/L)	0.3 L/ha (0.12 L/acre)	· May be used on processing and fresh market tomatoes. · Apply up to 4 POST applications per season. · Apply before the weeds are 2.5 cm in height. · BRAVO 500 fungicide may be tank-mixed with this treatment at 2.4–4.8 L/ha (1.2–2.4 kg/ha active). Control of annual grasses may be reduced. · **Do NOT** apply when crop is under stress due to cool, wet, cloudy weather or excessively hot temperatures. · **Do NOT** use on muck soils. · **Do NOT** use on soils with less than 2% organic matter. · **Do NOT** exceed the maximum total rate of SENCOR 480 F recommended on the label for your soil. · Preharvest interval is 30 days.
Postemergent Tank-Mix Options			
rimsulfuron (15 g/ha) + thifensulfuron methyl (4.125–6.0 g/ha) + non-ionic surfactant (0.2% v/v)	PRISM (25 DF) + PINNACLE SG (50%) + AGRAL 90 PRISM (25 SG) + PINNACLE SG (50%) + AGRAL 90	60 g/ha (24 g/acre) + 12 g/ha (4.8 g/acre) + 2 L/1,000 L water	· Use **ONLY** on transplant tomatoes grown for processing. · Apply POST through ground application, when hairy nightshade is up to the 4 leaf stage, quackgrass is in the 3–6 leaf stage (less than 10 cm tall), annual grasses are in the 1–6 leaf stage and redroot pigweed is at the 4–6 leaf stage. · Apply to weeds 10–21 days after transplanting tomatoes. · **Do NOT** apply in less than 200 L/ha (80 L/acre). · **Do NOT** apply if rain is expected within 2 h of application. · **Do NOT** apply to tomatoes that are stressed. · **Do NOT** apply within 45 days of harvest.

14. BERRY CROPS

NOTES: Weed control ratings are given as 0–9 where 0 indicates no control and 9 indicates 90%–100% control under ideal conditions. Ratings are subjective values based on best available information and give general comparisons based on use as described in this guide. Under unfavourable conditions (e.g., too dry, too wet, too cold, or poor application) the herbicides may not be as effective as indicated. Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used. Refer to product label for more information on registered weed species, product uses and precautions.

TABLE 14–1. Strawberry Herbicide Weed Control Ratings

LEGEND: Numbers (0–9) = weed control ratings – = insufficient information available to make a rating Refer to product label for list of species controlled.

	Annual Grasses						**Annual Broadleaves**									**Perennial Weeds**																
Trade Name	**barnyard grass**	**crabgrass**	**fall panicum**	**foxtails**	**witchgrass**	**volunteer grains**	**chickweed, common**	**groundsel**	**lady's-thumb**	**lamb's-quarters**	**mustards**	**pigweeds**	**ragweed**	**snapdragon, dwarf**	**violet, field (field pansy)**	**bindweeds**	**brome grass**	**chickweed, mouse-eared**	**daisy, ox-eye**	**dandelion**	**ground-ivy (creeping-charlie)**	**mallow**	**milkweed**	**nutsedge**	**plantains**	**poison-ivy**	**quackgrass**	**sorrel, sheep**	**sow-thistle**	**thistle, Canada**	**toadflax, yellow**	**vetches**
Soil Applied Grass and Broadleaf Herbicides																																
BONANZA **or** TREFLAN **or** RIVAL	8	9	8	9	8	9	8	3	7	8	3	8	4	–	–	2	–	5	0	0	0	0	2	2	0	0	2	0	2	2	0	0
CHATEAU	3	3	3	4	3	–	–	–	7	9	–	9	7	8	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
DACTHAL W-75	6	8	8	8	8	8	8	0	0	8	2	6	0	7	7	–	–	8	0	7	–	–	–	0	0	–	0	–	–	–	–	–
DEVRINOL	8	9	8	8	8	8	8	8	6	8	5	8	6	0	0	8[4]	8	–	–	2	–	–	5	5	2	–	5	0	5	5	–	0
DUAL II MAGNUM	9	9	9	9	9	–	–	–	2	7	2	7/8	4	–	–	0	–	–	–	5	–	–	0	8	5	–	4	–	0	0	–	0
GOAL 2XL	5	5	5	5	5	5	–	8	8	9	9	9	8	8	9	–	–	–	5	–	–	–	–	–	–	–	–	5	5	5	–	–
PRINCEP NINE-T	For weed control ratings, refer to Table 14–2, Berry Weed Control Ratings, on "TABLE 14–2. Berry Weed Control Ratings" on page 325.																															
SINBAR	8	7	8	8	8	8	8[2]	5	7[2]	8[2]	8[2]	7[2]	7[2]	2	5[2]	–	8	–	2	5	–	–	6	6	8	–	6	8	5	6	2	2
Postemergence Grass Herbicides																																
POAST + MERGE	9	8	9	9	9	9	0	0	0	0	0	0	0	0	0	0	–	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0
VENTURE L	9	9	9	9	9	9	0	0	0	0	0	0	0	0	0	0	9	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0

[1] Spot treatment only.

[2] Low rates and single applications may provide less control.

[3] Top growth only; regrowth can be expected. Repeated treatments may provide control.

[4] Seedling bindweed control only. This product will not control established bindweeds.

[5] Various products are available, see TABLE 4–1. Herbicides Used in Ontario, on page 30.

TABLE 14–1. Strawberry Herbicide Weed Control Ratings (cont'd)

LEGEND: Numbers (0–9) = weed control ratings – = insufficient information available to make a rating Refer to product label for list of species controlled.

	Annual Grasses						Annual Broadleaves									Perennial Weeds																
Trade Name	**barnyard grass**	**crabgrass**	**fall panicum**	**foxtails**	**witchgrass**	**volunteer grains**	**chickweed, common**	**groundsel**	**lady's-thumb**	**lamb's-quarters**	**mustards**	**pigweeds**	**ragweed**	**snapdragon, dwarf**	**violet, field (field pansy)**	**bindweeds**	**brome grass**	**chickweed, mouse-eared**	**daisy, ox-eye**	**dandelion**	**ground-ivy (creeping-charlie)**	**mallow**	**milkweed**	**nutsedge**	**plantains**	**poison-ivy**	**quackgrass**	**sorrel, sheep**	**sow-thistle**	**thistle, Canada**	**toadflax, yellow**	**vetches**
Postemergence Broadleaf Herbicides																																
AIM EC (Hooded Sprayer Application)	–	–	–	–	–	–	–	8	–	8	8	8	–	–	–	–	–	–	–	–	–	–	8	–	–	–	–	–	–	–	–	–
2,4-D[5]	0	0	0	0	0	0	2	2	4	8	9	7	8	2	2	2	0	2	2	8	2	0	0	0	8	–	0	8	6	8	–	5
LONTREL 360	0	0	0	0	0	0	0	8	–	5	–	5	9	–	–	0	0	0	8	8	0	0	0	0	0	0	0	9	8[3]	9	0	9
Postemergence Grass and Broadleaf Herbicides																																
BETAMIX	5	5	5	7	5	–	–	–	6	8	7	8	8	–	–	5	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	5
GRAMOXONE	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	8[3]	8[3]	8[3]	8[3]	8[3]	8[3]	8[3]	8[3]	8[3]	8[3]	8[3]	8[3]	8[3]	8[3]	8[3]	8[3]	8[3]
GLYPHOSATE[1,5]	9	9	9	9	9	9	9	8	9	8	9	9	8	–	–	7/8	9	9	–	8	5	5	9	8	9	9	8	8	9	9	8	5[2]

[1] Spot treatment only.

[2] Low rates and single applications may provide less control.

[3] Top growth only; regrowth can be expected. Repeated treatments may provide control.

[4] Seedling bindweed control only. This product will not control established bindweeds.

[5] Various products are available, see TABLE 4–1. Herbicides Used in Ontario, on page 30.

TABLE 14–2. Berry Weed Control Ratings

LEGEND: Numbers (0–9) = weed control ratings – = insufficient information available to make a rating ✓ = can be used on this crop x = not indicated for use on this crop
Refer to product label for list of species controlled.

	Crop Registrations				Annual Grasses						Annual Broadleaves						Perennial Weeds																	
Trade Name	blackberries	currants/gooseberries	highbush blueberries	raspberries	barnyard grass	crabgrass	fall panicum	foxtails	witchgrass	sandbur	chickweed, common	lady's-thumb	lamb's-quarters	mustards	pigweeds	ragweed	bindweed, field	chickweed, mouse-eared	dandelion	goldenrod	grape, wild	ground-ivy (creeping charlie)	mallow	milkweed	nightshade, climbing	nutsedge	plantains	poison-ivy	quackgrass	sow-thistle	stinging nettle	thistle, Canada	vetches	virginia creeper
Soil Applied Broadleaf Herbicides																																		
SANDEA	✓	x	✓	✓	0	0	0	0	0	–	8	8	8	8	8	8[6]	6	–	–	–	–	–	8	–	–	6	8	–	–	–	–	–	–	–
Soil Applied Grass and Broadleaf Herbicides																																		
CASORON	✓	x	✓	✓	7	6	6	6	7	–	8	7	8	3	8	4	7	7	7	–	5	6	–	–	–	7	7	5	7	7	–	7	7	–
CHATEAU	x	x	✓	x	3	3	3	4	3	–	–	7	9	–	9	7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
DEVRINOL	✓	x	✓	✓	8	9	8	8	8	8	7	6	8	5	8	7	–	–	5	–	–	–	–	5	–	5	5	1	5	5	–	5	1	–
DUAL II MAGNUM	x	x	✓	x	9	9	8	9	9	–	6	2	7	2	8	4	0	–	5	–	–	–	–	0	–	8	5	–	0	0	0	0	0	0
PRINCEP NINE-T **or** SIMADEX **or** SIMAZINE 480	✓	x	✓	✓	8	8	6	8	8	–	8	9	9	9	9	8	2	–	5	–	–	–	–	0	–	5	–	–	6	5	–	5	0	–
SENCOR	x	x	✓	✓	7	8	9	8	9	–	9	9	9	9	8	8	2	–	–	–	–	–	–	2	2	2	–	–	2	2	–	2	2	0
SINBAR	x	x	✓	x	8	7	8	8	8	5	9	7	8	8	7	7	6	8	6	–	–	–	–	6	–	6	8	–	6	1	–	6	1	–
Postemergence Grass Herbicides																																		
POAST ULTRA	x	x	✓	✓	8	8	9	8	9	–	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0
SELECT	x	x	✓	✓	8	8	9	8	9	–	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0
VENTURE L	x	x	✓	✓	9	9	9	9	9	–	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0

[1] Top growth only; regrowth can be expected.

[2] Use higher rates when larger than 15 cm tall or across.

[3] Yellow foxtail will only be suppressed

[5] Weeds cannot be emerged at time of application to achieve this level of control.

[6] Registered for preemergent activity on common ragweed only.

[7] Various formulations available, See Table 4–1. Herbicides Used in Ontario, page 30. Not all formulations are registered on all crops. See label for specific uses and rates.

TABLE 14–2. Berry Weed Control Ratings (cont'd)

LEGEND: Numbers (0–9) = weed control ratings – = insufficient information available to make a rating ✓ = can be used on this crop x = not indicated for use on this crop
Refer to product label for list of species controlled.

Trade Name	Crop Registrations				Annual Grasses						Annual Broadleaves						Perennial Weeds																	
	blackberries	currants/gooseberries	highbush blueberries	raspberries	barnyard grass	crabgrass	fall panicum	foxtails	witchgrass	sandbur	chickweed, common	lady's-thumb	lamb's-quarters	mustards	pigweeds	ragweed	bindweed, field	chickweed, mouse-eared	dandelion	goldenrod	grape, wild	ground-ivy (creeping charlie)	mallow	milkweed	nightshade, climbing	nutsedge	plantains	poison-ivy	quackgrass	sow-thistle	stinging nettle	thistle, Canada	vetches	virginia creeper
Postemergence Broadleaf Herbicides																																		
AIM EC (Hooded Sprayer Application)	✓	✓	✓	✓	–	–	–	–	–	–	–	–	8	8	8	–	–	–	–	–	–	–	8	–	8	–	–	–	–	–	–	–	–	–
BASAGRAN	x	x	✓	x	0	0	0	0	0	0	8	9	7	8	8	8	7	–	–	–	–	–	–	5	2	8[1]	2	–	2	5	8[1]	6	5	–
CALLISTO	x	x	✓	x	–	–	–	–	–	–	–	–	9	9	9	7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
GOAL 2XL	x	x	✓	x	5	5	5	5	5	–	7	8	8	9	9	8	5	–	8	–	–	–	–	5	–	5	–	–	5	5	–	5	0	–
SANDEA	x	x	✓	x	0	0	0	0	0	0	8[5]	8[5]	8[5]	8	8	8	6	–	–	–	–	–	–	8	7	–	9	8	–	–	–	–	–	–
2,4-D[7]	x	x	✓	✓	0	0	0	0	0	–	7	4	8	9	9	8	5	2	8	2	5	2	2	2	–	2	8	–	2	6	–	8	5	–
Postemergence Grass and Broadleaf Herbicides																																		
GLYPHOSATE[7]	✓	✓	✓	✓	9	9	9	9	9	–	9	9	9	9	9	9	8	9	8/9[2]	–	8	5	5	9	–	5	9	9	9	9	5	9	5[1]	8[1]
GRAMOXONE	✓	✓	✓	✓	9	9	9	9	9	–	9	9	9	9	9	9	8[1]	8[1]	8[1]	8[1]	8[1]	8[1]	8[1]	8[1]	8[1]	8[1]	8[1]	8[1]	8[1]	8[1]	8[1]	8[1]	8[1]	8[1]
IGNITE	x	x	✓	✓	9	9	9	9	9	–	9	9	9	8	9	9	8[1]	8[1]	8[1]	8[1]	8[1]	8[1]	8[1]	8[1]	8[1]	8[1]	8[1]	8[1]	5	9	8[1]	8[1]	8[1]	8[1]
PRISM	✓	x	✓	✓	9	8	9	8[3]	9	–	–	7	7	9	9	3	–	–	–	–	–	–	–	–	–	–	–	–	7	–	–	–	–	–

[1] Top growth only; regrowth can be expected.

[2] Use higher rates when larger than 15 cm tall or across.

[3] Yellow foxtail will only be suppressed

[5] Weeds cannot be emerged at time of application to achieve this level of control.

[6] Registered for preemergent activity on common ragweed only.

[7] Various formulations available, See Table 4–1. Herbicides Used in Ontario, page 30. Not all formulations are registered on all crops. See label for specific uses and rates.

Cultural Weed Control in Berry Crops

A successful weed control program must integrate cultural and chemical weed control practices. Growers cannot depend entirely on chemical weed control in berry crops, since there is a limited spectrum of herbicides registered for these crops.

Perennial Weed Control

It is important to identify and control perennial weeds in the preplanting year. It is very difficult to control perennial weeds once a planting is established because of crop sensitivity to some herbicides and since it is not possible to clean cultivate in established berry crops.

The following perennial weeds present serious problems in these crops: quackgrass, bindweed, vetch, wild grape, perennial nightshade, thistles, ground-ivy (creeping charlie) and burdock. In strawberries, sheep sorrel, toad flax and milkweed also present problems.

Systemic herbicides such as glyphosate should be applied to perennial weeds in the preplanting year. Consult the product label and be sure to use the recommended rate for the weed in question. Apply the herbicide at the proper stage of growth of the weed, otherwise only temporary control will be achieved. Repeated cultivation of some perennial weeds such as bindweed will also provide control.

Site Preparation

A green manure crop such as perennial ryegrass, Sudan grass, oilseed radish, tillage radish or mustards should be established in the preplanting year following or in conjunction with measures to control perennial weeds. This crop will provide competition to reduce weed growth as well as improve the soil structure. Non-selective herbicides can be applied before planting the green manure crop and before plowing it under. Short residual selective herbicides such as 2,4-D may be used with the green manure crop, but avoid using herbicides that leave a soil residue that will carry over into the planting year. See Chapter 6, *Preplant – Site Preparation Prior to any Crop*, page 95.

Mulching

For bramble and bush fruit, biodegradable plastic mulch could be used for weed control in the planting strip. Straw mulch will also assist in weed control beneath the plants or in the planting strip if it is applied early in the season before the weed seeds germinate. Use mulch that is free of weed seeds and ensure that enough nitrogen is provided for the plants. The mulch should be pulled away from around the plants for winter rodent protection.

For strawberries, use of straw mulch before weeds germinate can help control weeds. Some growers are trying plasticulture as a way to improve weed control.

Reducing Weed Pressure

Cultivation can provide weed control between the rows. In bramble and bush fruit, a vigorous sod between the rows will prevent weeds from becoming established. It is better to seed in a fescue sod rather than rely on a natural sod composed of weed and grass species, because the weeds will seed into the herbicide strip.

Prevent weeds from setting seed in adjacent uncropped areas by using cultural or chemical weed control measures. Mowing at regular intervals will prevent many weeds from flowering. Try to control weeds that escape before they set seed, by cultural removal or chemical mowing. In some situations, tools such as a weed whip may be of use. Mowers are available which will cut close to the plants without injury. Mowing, however, will not eliminate weed competition.

Rotating Herbicide Families

(See Table 4–5. *Herbicide Crop Rotation and Soil pH Restrictions: Horticultural Crops*, page 76).

In perennial crops, rotation of herbicide families is important to minimize the build up of seed from weed escapes, including triazine tolerant weeds. Rotation will also help avoid an accumulation of herbicide residues in the soil that may result in crop injury over a period of years and may hinder replanting.

Herbicide Application Timings

Preplant (PP) Treatments
Preplant treatments are applied before the berry field is planted. Some of these herbicides kill seedlings soon after germination while others also kill weed seeds. Most herbicides used for these treatments must be thoroughly incorporated into the soil by cultivation soon after application. Check the label. Also see *Preplant Weed Control, Preplant – Site Preparation Prior to any Crop*, page 95 for details of products, rates and remarks.

Preplant (PP) Weed and Cover Crop Control
Control cover crops and emerged weeds before planting berry crops. Refer to Table 6–1. *Non-Selective Herbicides Available for Preplant Site Preparation*, page 91. Alternatively, a grower may choose to kill the cover crop and/or emerged weeds just before planting the berry crop and either till the area or leave the seedbed untilled.

Preplant Incorporated (PPI)
Two incorporations at right angles operating at a depth of 10 cm using a double disk (7–10 km/h) or vibrating shank S-tine cultivator (10–13 km/h) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Special attention should be directed toward machinery cleanliness, and/or treating fields with perennial weeds last.

Preemergence (PRE)

Rainfall at 15–20 mm within 7–10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall. These materials prevent emergence of many weed seedlings without reducing crop stand. Apply immediately after seeding or at least before the emergence of the crop. If these materials are applied after weeds have emerged, kill is usually poor. Best results are obtained with this method when conditions for weed seed germination are good.

Postemergence (POST)

These chemicals are applied after the berry crop is planted. Applied as directed, the weeds can be killed without injury to the crop. Leaf stage of the weeds is critical for good control. Smaller weeds are generally easier to kill but there needs to be enough leaf surface to intercept the herbicide. Apply according to leaf stages specified on pesticide label. Crop stage is important to optimize crop safety. Adjuvants will frequently improve the weed control when used as directed. Weather or other conditions may influence the optimum rate of adjuvant, see the product label for more details. Always use appropriate drift management technology.

Inter-Row Weeding

The herbicide is directed between the berry crop rows onto the emerged weeds. The herbicide is used as a rescue operation where other methods of weed control have failed. Use special low pressure (7–15 kPa) applicators such as dribble bars or vibra jets equipped with shields to prevent wetting the crop. See *Stale Seedbed and Inter-Row Weeding*, page 96.

Wiper Applicators for Selective Weed Control

Wiper applicators (rope-wick, roller applicator or similar device) have been extensively used with glyphosate. Check product labels for use of this application technique with other herbicides.

TABLE 14–3. Herbicide Treatment Rates for Berry Crops

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more Information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants,page 81.
BLUEBERRIES, HIGHBUSH			
Site Preparation Before Planting – See Chapter 6, Preplant and Postharvest Weed Control, page 91.			
CULTURAL WEED CONTROL – see Cultural Weed Control in Berry Crops, page 327. **Mulching:** Biodegradable mulch could be used for weed control within the plant row. Sawdust mulch will assist in weed control if it is applied early in the season before the weed seeds germinate. Apply sawdust 5 cm thick. The mulch will not prevent the germination of weed seeds that may blow onto the surface of the mulch. In subsequent years, the organic matter in the mulch may tie up and thus reduce the effectiveness of certain residual herbicides. The nitrogen requirements of the crop will change as the mulch is degraded. Initially nitrogen will be consumed by micro-organisms, thus necessitating higher rates of nitrogen fertilizer. Later, as the sawdust is degrading, nitrogen will be released and the crop may require less nitrogen fertilizer than an unmulched crop. It may take 2 years or more for sawdust mulch to significantly decompose. Adjust fertilizer rates according to mulch breakdown, plant growth and leaf nutrient analysis results. **Rates per hectare or per acre refer to area actually treated with herbicide.** **CAUTION** – Simazine, DEVRINOL and SINBAR residues, high enough to harm many crops, may persist for several years after removal of the planting.			
Soil Applied Broadleaf Herbicide			
halosulfuron (25–51 g/ha)	SANDEA (72.6 WG)	35–70 g/ha (14–28 g/acre)	· **New, 1 year or more and established plantings ONLY.** · **Do NOT** apply to Elliot variety blueberries · 1–4 year bushes apply 35–47 g/ha (14–19 g/acre). · Older than 4 year bushes apply 35–70 g/ha (14–28 g/acre). · Apply as a single or sequential application. · Allow a minimum of 45 days between applications. · Do not apply more than 140 g/ha (56 g/acre) per season. · Use a minimum water volume of 140 L/ha (56 L/acre). · Rains greater than 2.5 cm within 5–7 days of application may cause temporary yellowing and delay development of crop. · **Do NOT** contact green tissue. · **Do NOT** spray over top of plastic mulch. · **Do NOT** harvest within 14 days after application.

TABLE 14–3. Herbicide Treatment Rates for Berry Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 33 and Chapter 5, Notes on Adjuvants, page 85.
BLUEBERRIES, HIGHBUSH (cont'd)			
Soil Applied Grass and Broadleaf Herbicides			
mesotrione (0.144 kg/ha)	CALLISTO 480SC (480 g/L)	0.3 L/ha (0.12 L/acre)	· PRE and up to the 2 leaf stage of weeds. · POST to weeds from the 3–8 leaf stage with Agral 90 at 0.2% v/v. · **ONLY** 1 application per year. · Apply up to the 8 leaf stage of weeds and prebloom of the crop. · Apply by broadcast (direct spray to base of plant) ground application. · Apply in 100–200 L/ha (40–80 L/acre) water. · **Do NOT** harvest within 60 days of application. · **Do NOT** apply by air.
dichlobenil (7–9 kg/ha)	CASORON G-4 (4 Gr)	175–225 kg/ha (70–90 kg/acre)	· **Established plantings ONLY.** · PRE – Apply to cool moist but unfrozen soil in late fall or spring before weeds emerge. · Use the higher application rate of 225 kg/ha (90 kg/acre) **ONLY** every other year. · **Do NOT** apply if air temperatures are above 10°C–15°C to avoid injury from volatilization. · Use the lower rate if irrigation or rain will follow application. · 70 g applied to an area 2 × 2 m is equivalent to 175 kg/ha (70 kg/acre). · **Use ONLY** under plants established for at least 3 years. · **Do NOT** use on light, sandy soil.
flumioxazin (0.14–0.21 kg/ha)	CHATEAU WDG (51.1%)	0.28–0.42 kg/ha (0.11–0.17 kg/acre)	· **Established plantings ONLY.** · Maximum 2 applications per growing season at least 30 days apart. · **Do NOT** apply to blueberries established for less than 2 years. · **Do NOT** apply after budbreak unless using hooded or shielded equipment. · Apply prior to weed emergence. · Apply lower rate on sandy (coarse textured) soils with less than 5% organic matter and the higher rate on clay (medium textured) soils with less than 5% organic matter. · Apply using ground application **ONLY.** · **Do NOT** apply through irrigation equipment. · After use, tanks and nozzles must be cleaned with a 3% ammonia solution. Please review label for more detailed instructions. · **Do NOT** harvest within 60 days of application.
napropamide (4.5 kg/ha)	DEVRINOL DF (50 DF)	9 kg/ha (3.6 kg/acre)	· **New and established plantings.** · PRE – Apply once per season, either in the fall or spring, before weeds emerge. · Incorporation by rainfall or irrigation is essential. · **Do NOT** apply to frozen ground. · **Do NOT** apply within 70 days of harvest.
	DEVRINOL DF-XT (50 DF-XT)		
s-metolachlor/benoxacor (1.14–1.6 kg/ha)	DUAL II MAGNUM (915 g/L)	1.25–1.75 L/ha (0.5–0.7 L/acre)	· **New and established plantings.** · Pre-emergent to weeds. **Do NOT** apply by air, ground application **ONLY.** · Make **ONLY** 1 application per year. · Apply in 150–300 L/ha (60–120 L/acre) water. · Apply as a banded application, directed at base of plants. · Avoid contact with trunk and foliage. · **Do NOT** harvest within 30 days of application.

TABLE 14–3. Herbicide Treatment Rates for Berry Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 33 and Chapter 5, Notes on Adjuvants, page 85.
BLUEBERRIES, HIGHBUSH (cont'd)			
Soil Applied Grass and Broadleaf Herbicides (cont'd)			
simazine (2.25–3.38 kg/ha)	PRINCEP NINE-T (90 WG)	2.5–3.75 kg/ha (1–1.5 kg/acre)	· **Established plantings of 1 year or more ONLY.** · PRE – Apply in 300–1,000 L/ha (120–400 L/acre) water before weed emergence. · Use lower rates for coarse, sandy soil. · Use higher rates for clay or higher organic matter soil. · Apply **ONCE** a year to the base of plants in early spring. · Avoid spraying young shoots.
	SIMAZINE 80W (80 WP)	2.75–4.25 kg/ha (1.1–1.7 kg/acre)	
metribuzin (0.75 kg/ha)	SENCOR 75 DF (75WG)	1 kg/ha (0.4 kg/acre)	· **New plantings ONLY.** · Apply as a directed application in a band under the bushes. · Apply to weed-free soil after planting. · Apply **ONCE** a year. · Apply in 150–300 L/ha (60–120 L/acre) water. · Light rain or irrigation is needed to move herbicide into soil. · **Do NOT** use on soils with less than 2% organic matter. · **Do NOT** harvest blueberries for 2 years.
terbacil (2.2–3.4 kg/ha)	SINBAR (80 WP)	2.75–4.25 kg/ha (1.1–1.7 kg/acre)	· **Established plantings ONLY.** · PRE – Apply in 200–1,000 L/ha (80–400 L/acre) water. · Use only in plantings established in the field for at least 1 year. · Make 1 application per year. · Injury may occur on sandy soil even with the low rate. · Use the high rate only on muck or peat soils where experience has shown this to be a safe practice.
	SINBAR (80 WDG)		
Postemergence Grass Herbicides			
sethoxydim (0.14–0.5 kg/ha) + surfactant/solvent (0.25–2 L/ha)	POAST ULTRA (450 g/L) + MERGE	0.32–1.1 L/ha (0.13–0.44 L/acre) + 0.25–2 L/ha (0.1–0.8 L/acre)	· **New and established plantings.** · Apply to actively growing grasses. · For annual grass, use 0.32 L/ha (0.13 L/acre). Apply at the 1–6 leaf stage (2–5 is optimum). · For volunteer grains, use 0.47 L/ha (0.19 L/acre). Apply at the 1–6 leaf stage (2–5 is optimum). · For quackgrass, use 1.1 L/ha (0.44 L/acre). Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days. Use the high rate of MERGE for quackgrass. · Use 100–200 L/ha (40–80 L/acre) water. · Grasses emerging after application will not be controlled. · Spray tips angled forward 45° will give better coverage. · **Do NOT** use flood jet or hollow cone nozzles. · **Do NOT** apply if rain is expected within 1 hr after application. · Pre-harvest interval is 1 day. · Up to 2 applications per year not exceeding a total maximum application rate of 1.1 L/ha (0.45 L/acre) per season. Minimum of 14 days between applications.

TABLE 14–3. Herbicide Treatment Rates for Berry Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 33 and Chapter 5, Notes on Adjuvants, page 85.
BLUEBERRIES, HIGHBUSH (cont'd)			
Postemergence Grass Herbicides (cont'd)			
clethodim (0.46–0.091 L/ha) + surfactant (0.5–1.0% v/v)	SELECT (240 g/L) + AMIGO ARROW (240 g/L) + X-ACT	0.19–0.38 L/ha (0.08–0.15 L/acre) + 5–10 L/1,000 L	· Blueberries are tolerant at all stages of growth. · Apply ONCE a season. · Apply using ground equipment. · For quackgrass, use the higher application rate of 0.38 L/ha (0.15 L/acre). · **Do NOT** harvest for 14 days after application. · Use in a minimum 100 L/ha (40 L/acre) water.
fluazifop-p-butyl (0.075–0.25 kg/ha)	VENTURE L (125 g/L)	0.6–2 L /ha (0.24–0.8 L/acre)	· **New and established plantings.** · Apply POST to actively growing grasses before tillering. · Apply at 0.6 L/ha (0.24 L/acre) at 2–5 leaf stage of volunteer corn. · Apply at 0.8 L/ha (0.32 L/acre) at 2–5 leaf stage of volunteer wheat and barley. · Apply at 1 L/ha (0.4 L/acre) at 2–5 leaf stage of annual grasses (2 leaf for foxtails). · Apply at 2 L/ha (0.8 L/acre) at 3–5 leaf stage of quackgrass and wirestem muhly. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days. · **Do NOT** apply closer than 15 days to harvest. · Apply in 100–300 L/ha (60–120 L/acre) water.
Postemergence Broadleaf Herbicides			
2,4-D (0.95 kg/ha)	2,4-D Amine (560 g/L)	1.7 L/ha (0.69 L/acre)	· Ground application **ONLY**. · Directed spray between rows of the crops in 60–240 L/ha of water in early spring after weeds have emerged and are actively growing. **Do NOT** overspray. · **Do NOT** apply more than once per season. · Pre-harvest interval is 30 days. · Restricted-entry interval is 12 h.
carfentrazone-ethyl (8.8–28.1 g/ha) + non-ionic surfactant (0.25% v/v)	AIM EC (240 g/L) + AGRAL 90 AIM EC (240 g/L) + AG-SURF	36.5–117 mL/ha (14.6–46.8 mL/acre) + 2.5 L/1,000 L	· **New and established plantings.** · Apply POST with a hooded sprayer between the rows or between the plastic mulch. · Apply to actively growing weeds up to 10 cm tall. · Apply in a minimum of 100 L/ha (40 L/acre) water. · **Do NOT** apply closer than 1 day to harvest. · Apply **ONLY** once per growing season. · Crop injury may occur if the spray is allowed to come in contact with the green stem, leaves, bloom or fruit.
carfentrazone-ethyl (8.8–28.1 g/ha) + surfactant/solvent (0.1% v/v)	AIM EC (240 g/L) + MERGE	36.5–117 mL/ha (14.6–46.8 mL/acre) + 1 L/1,000 L	
bentazon (0.84 kg/ha) + oil concentrate (0.5% v/v)	BASAGRAN (480 g/L) + ASSIST	1.75 L/ha (0.7 L/acre) 5 L/1,000 L	· **Established plantings ONLY.** · For top growth control of yellow nutsedge. · Make 2 applications 7–10 days apart, when weeds are small. · Apply in 100–400 L/ha (40–160 L/acre) water. · **Do NOT** apply more than 2 times per year. · **Do NOT** apply closer than 25 days to harvest.

TABLE 14–3. Herbicide Treatment Rates for Berry Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 33 and Chapter 5, Notes on Adjuvants, page 85.
BLUEBERRIES, HIGHBUSH (cont'd)			
Postemergence Broadleaf Herbicides (cont'd)			
mesotrione (0.144 kg/ha)	CALLISTO 480SC (480 g/L)	0.3 L/ha (0.12 L/acre)	· POST to weeds from the 3–8 leaf stage with AGRAL 90 at 0.2% v/v. · **ONLY** 1 application per year. · Apply up to the 8 leaf stage of weeds and prebloom of the crop. · Apply by broadcast (direct spray to base of plant) ground application. · Apply in 100–200 L/ha (40–80 L/acre) water. · **Do NOT** harvest within 60 days of application. · **Do NOT** apply by air.
oxyfluorfen (0.24 g/ha)	GOAL 2XL (240 g/L)	1 L/ha (0.4 L/acre)	· Apply POST as a band on either side of the blueberry row. · Apply when weeds are at 2–4 leaf stage and are actively growing. · Use a minimum water volume of 140 L/ha (56 L/acre). · **Do NOT** apply more than once a year. · **Do NOT** harvest within 50 days of application. · **Do NOT** apply to sandy soil.
clopyralid (0.15–0.3 kg/ha)	LONTREL 360 (360 g/L)	0.42–0.83 L/ha (0.17–0.33 L/acre)	· **New and established plantings.** · Apply once per year, directed under the bushes on emerged weeds. · For emerged vetch, use 0.42 L/ha (0.17 L/acre). · For red and white clover, use 0.83 L/ha (0.33 L/acre). · **Do NOT** apply closer than 45 days to harvest.
halosulfuron (25–51 g/ha) + non-ionic surfactant (0.2% v/v)	SANDEA (72.6 WG) + non-ionic surfactant	35–70 g/ha (14–28 g/acre) 2.5 L/1,000 L	· **New, 1 year or more and established plantings ONLY.** · **Do NOT** apply to Elliot variety blueberries · 1–4 year bushes apply 35–47 g/ha (14–19 g/acre). · Older than 4 year bushes apply 35–70 g/ha (14–28 g/acre). · Apply as a single or sequential application; allow a minimum of 45 days between applications. · For nutsedge control, apply when fully emerged. If applying twice, apply first application at 3–5 leaf stage. For best results apply 52.5 g/ha (21 g/acre) on bushes older than 4 years. · Do not apply more than 140 g/ha (56 g/acre) per season. · Use a minimum water volume of 140 L/ha (56 L/acre). · Rains greater than 2.5 cm within 5–7 days of application may cause temporary yellowing and delay development of crop. · **Do NOT** contact green tissue. · **Do NOT** spray over top of plastic mulch. · **Do NOT** harvest within 14 days after application.

TABLE 14–3. Herbicide Treatment Rates for Berry Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 33 and Chapter 5, Notes on Adjuvants, page 85.
BLUEBERRIES, HIGHBUSH (cont'd)			
Postemergence Grass and Broadleaf Herbicides			
rimsulfuron (15 g/ha) + non-ionic surfactant (0.2% v/v)	PRISM (25 SG) + AGRAL 90	60 g/ha (24 g/acre) + 2 L/1,000 L	· **Established plantings of 1 year or more ONLY.** · Apply when quackgrass is at 3–6 leaf stage (less than 10 cm tall), annual grasses at 1–6 leaf stage and redroot pigweed is in the 4–6 leaf stage. · Apply on highbush blueberries that are in good health and vigour. · Always add water soluble packages to clean water with agitator running. · Use a directed spray application to completely cover weeds, while minimizing amount of spray on blueberry plants. · Use a minimum of 100 L/ha (40 L/acre) water. · **Do NOT** harvest within 21 days after application.
	PRISM (25 SG) + AG-SURF		
Non-Selective Herbicides and Tank Mix Options			
glyphosate (1–2 kg/ha)	glyphosate (360 g/L)*	2.8–5.6 L/ha (1.12–2.24 L/acre)	· **New and established plantings.** · Apply as a directed spray under the bushes, avoiding new shoots. · Apply in 200–300 L/ha (80–120 L/acre) water, using no more than 275 kPa pressure. · Avoid contact with fruit, foliage or canes. · Use **ONLY** 1 application per season. · **Do NOT** apply closer than 30 days to harvest. * See Table 4–1. Herbicides Used in Ontario, page 30, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.
	glyphosate (480 g/L)*	2.1–4.2 L/ha (0.83–1.67 L/acre)	
	glyphosate (500 g/L)*	2.0–4.0 L/ha (0.8–1.6 L/acre)	
	glyphosate (540 g/L)*	1.85–3.7 L/ha (0.74–1.48 L/acre)	
paraquat (1.1 kg/ha)	GRAMOXONE (200 g/L)	5.5 L/ha (2.2 L/acre)	· **Established plantings ONLY.** · Apply in 1,100 L/ha (440 L/acre) water. · For spot spraying, apply 55 mL product/10 L water sprayed to wet weed foliage. · Use on plantings established at least 1 year.
paraquat (1 kg/ha) + simazine (1.8–2.25 kg/ha)	GRAMOXONE (200 g/L) + PRINCEP NINE-T (90 WG)	5 L/ha (2 L/acre) + 2–2.5 kg/ha (0.8–1 kg/acre)	· **Established plantings ONLY.** · For emerged weeds with residual control of germinating weeds. · Apply as a directed spray to established plantings. · Use 1,000 L/ha (400 L/acre) water to wet weed foliage. · Use lower rates for coarse, sandy soil. · Use higher rates for clay or higher organic matter soil.
glufosinate ammonium (0.41–0.75 kg/ha)	IGNITE (150 g/L)	2.7–5 L/ha (1.08–2 L/acre)	· **Established plantings ONLY.** · **Do NOT** apply to immature and weak plantings. · May be applied by ground spray equipment, high volume, orchard spray guns, or hand-held pump-type and backpack sprayers. · Repeat treatment may be necessary. · **Do NOT** apply more than twice a year. · **Do NOT** apply more than 6.7 L/ha (2.7 L/acre) of product during a season. · Avoid spray contact with foliage and bark. · It is not necessary to remove suckers prior to application. · Apply in 330–1,100 L/ha (132–440 L/acre) water. · **Do NOT** harvest for 14 days after application.

TABLE 14–3. Herbicide Treatment Rates for Berry Crops (cont'd)

CRANBERRIES

Maintaining a healthy and vigorous crop will aid in weed control by avoiding openings in the bed for weed germination and establishment.

Prevent weeds from setting seed on dikes and in adjacent uncropped areas by using cultural or chemical weed control measures. Mowing at regular intervals will prevent many weeds from setting seed. Seeding the dikes with a desirable grass cover will reduce the opportunities for weed establishment and will provide bank stabilization.

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 33 and Chapter 5, Notes on Adjuvants, page 85.
Soil Applied Grass and Broadleaf Herbicides			
mesotrione (0.1–0.144 kg/ha)	CALLISTO 480SC (480 g/L)	0.21–0.30 L/ha (0.084–0.12 L/acre)	· **Established plantings ONLY.** · PRE or POST – **ONLY** 1 application per year. · Apply by ground boom equipment. · PRE – Apply in 200 L/ha (80 L/acre) water. · POST – Apply in 100–200 L/ha (40–80 L/acre) water at 206–300 kPa. · LATE POST – Use the lowest application rate. · Bearing Buds – Apply between bud break and fruit set. **Do NOT** harvest within 60 days of application. · Non-Bearing Buds – Apply between bud break and 60 days before fall or winter flooding. **Do NOT** harvest within 1 year of application. · **Do NOT** flood within 60 days of treatment. · **Do NOT** apply if sprinkler irrigation for frost protection or rainfall is expected within 48 h of application. · **Do NOT** apply by hand. · **Do NOT** apply through irrigation equipment. · **Do NOT** enter or allow worker entry into treated areas during 12 h after application.
dichlobenil (4.4 kg/ha)	CASORON G-4 (4 Gr)	110 kg/ha (44 kg/acre)	· **Established plantings ONLY.** · PRE – For annual broadleaf weeds, certain sedges and Juncus species. · Apply in early spring prebloom. · Temporary reddening of plants may occur, especially with late spring applications. · **Do NOT** use on new plantings, or on newly sanded beds. · **Do NOT** use on beds recently mowed for vines.
napropamide (4.5–6.7 kg/ha)	DEVRINOL 10G (10%)	45–67 kg/ha (18–26.8 kg/acre)	· **Established plantings ONLY.** · PRE – Apply once per year in spring and irrigate immediately. · **Do NOT** use on new beds.
	DEVRINOL DF-XT (50 DF-XT)	9–13.4 kg/ha (3.6–6.7 kg/acre)	

TABLE 14–3. Herbicide Treatment Rates for Berry Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 33 and Chapter 5, Notes on Adjuvants, page 85.
CRANBERRIES (cont'd)			
Postemergence Grass Herbicides			
sethoxydim (0.14–0.5 kg/ha) + surfactant/solvent (0.25–2 L/ha)	POAST ULTRA (450 g/L) + MERGE	0.32–1.1 L/ha (0.13–0.44 L/acre) 0.25–2 L/ha (0.1–0.8 L/acre)	· **New and established plantings.** · Apply to actively growing grasses. · For annual grass, use 0.32 L/ha (0.13 L/acre). Apply at the 1–6 leaf stage (2–5 is optimum). · For volunteer grains, use 0.47 L/ha (0.19 L/acre). Apply at the 1–6 leaf stage (2–5 is optimum). · For quackgrass, use 1.1 L/ha (0.44 L/acre). Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Use the high rate of MERGE for quackgrass. · Grasses emerging after application will not be controlled. · Use 100–200 L/ha (40–80 L/acre) water. · Spray tips angled forward 45° will give better coverage. · **Do NOT** use flood jet or hollow cone nozzles. · **Do NOT** apply if rain is expected within 1 h after application. · **Do NOT** apply closer than 15 days to harvest.
fluazifop-p-butyl (0.075–0.25 kg/ha)	VENTURE L (125 g/L)	0.6–2 L/ha (0.24–0.8 L/acre)	· **New and established non-bearing plantings.** · Apply POST to actively growing grasses before tillering. · Apply at 0.6 L/ha (0.24 L/acre) at 2–5 leaf stage of volunteer corn. · Apply at 0.8 L/ha (0.32 L/acre) at 2–5 leaf stage of volunteer wheat and barley. · Apply at 1 L/ha (0.4 L/acre) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails). · Apply at 2 L/ha (0.8 L/acre) at 3–5 leaf stage of quackgrass and wirestem muhly. Thorough preplant tillage will ensure more uniform quackgrass emergence. · Use **ONLY** 1 application per season.
Postemergence Broadleaf Herbicides			
2,4-D (0.47 kg/2 L water)	2,4-D (470 g/L)	1 L/2 L water	· **New and established plantings.** · For emerged annual and perennial weeds, including hardhack, St. John's Wort, alder and purple aster. · Apply with a ropewick or other wiper to actively growing weeds (June to July). · **Do NOT** contact the crop. · Use **ONLY** 1 application per year. · **Do NOT** apply closer than 50 days to harvest.
	2,4-D (564 g/L)	1 L/2.6 L water	
	2,4-D (660 g/L)	0.71 L/2 L water	

TABLE 14–3. Herbicide Treatment Rates for Berry Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 33 and Chapter 5, Notes on Adjuvants, page 85.
CRANBERRIES (cont'd)			
Postemergence Broadleaf Herbicides (cont'd)			
mesotrione (0.1 kg/ha) + non-ionic surfactant (0.2% v/v)	CALLISTO 480SC (480 g/L) + AGRAL 90	0.21 L/ha (0.084 L/acre) + 2 L/1,000 L	· **LATE POST** – at the 3 to 8 leaf stage of weeds. · Maximum 2 applications per year. Allow 14 days between applications. · Bearing Buds – Apply between bud break and fruit set. **Do NOT** harvest within 60 days of application. · Non-Bearing Buds – Apply between bud break and 60 days before fall or winter flooding. **Do NOT** harvest within 1 year of application. · **Do NOT** flood within 60 days of treatment. · **Do NOT** apply if sprinkler irrigation for frost protection or rainfall is expected within 48 h of application. · **Do NOT** apply by hand. · **Do NOT** apply through irrigation equipment. · **Do NOT** enter or allow worker to enter within the restricted entry interval (REI) of 12 h.
clopyralid (7.2 g/L water)	LONTREL 360 (360 g/L)	20 mL/L water (2% solution)	· **New and established plantings.** · For emerged vetch. · **Do NOT** use more than 2 applications a year – in spring before bud break, again until growth is 1–2 mm long, and/or in the fall at least 2 weeks after harvest, when vines have winter dormancy colour. · Apply with wiper equipment onto weed foliage that extends above the cranberry canopy. Avoid contact with cranberry shoots after growth begins. · **Do NOT** apply closer than 60 days to harvest.
Non-Selective Herbicides			
glyphosate (0.36 kg/4 L of water)	glyphosate (360 g/L)*	1 L/4 L of water	· **New and established plantings.** · Apply with a rope wick or other similar device when weeds are 15 cm above the crop. · Avoid contact with the cranberry vines. · **Do NOT** apply when weeds are wet. · See Wick Wiper and Roller Application, page 100. * See Table 4–1. Herbicides Used in Ontario, page 30, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.
	glyphosate (480 g/L)*	0.75 L/4 L of water	
	glyphosate (500 g/L)*	0.72 L/4 L of water	
	glyphosate (540 g/L)*	0.62 L/4 L of water	
CURRANTS AND GOOSEBERRIES			
Cultural Weed Control – See notes on Cultural Weed Control in Berry Crops, page 327. There are no herbicides registered for preemergence weed control in currants and gooseberries. A biodegradable mulch could be used for weed control in the planting strip. A straw mulch will assist in weed control. **Rates per hectare or per acre refer to area actually treated with herbicide.**			
Site Preparation Before Planting – See Chapter 6, Preplant & Postharvest Weed Control, page 91.			
Non-Selective Herbicides			
paraquat (1.1 kg/ha)	GRAMOXONE (200 g/L)	5.5 L/ha (2.2 L/acre)	· **Established plantings ONLY.** · Apply in 1,100 L/ha (440 L/acre) water. · For spot treatment, apply 55 mL in 10 L of water, sprayed to wet weed foliage. · Direct spray to wet the weeds but avoid wetting the leaves or green bark of the bushes.

TABLE 14–3. Herbicide Treatment Rates for Berry Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 33 and Chapter 5, Notes on Adjuvants, page 85.
RASPBERRIES			
Cultural Weed Control – See notes on Cultural Weed Control in Berry Crops, page 327.			
Site Preparation Before Planting – See Chapter 6, Preplant & Postharvest Weed Control, page 91.			
Rates per hectare or per acre refer to area actually treated with herbicide. CAUTION: Simazine and DEVRINOL residues, high enough to harm many crops, may persist for several years after removal of a planting.			
Soil Applied Grass and Broadleaf Herbicides			
dichlobenil (4.4–7 kg/ha)	CASORON G-4 (4 Gr)	110–175 kg/ha (45–70 kg/acre)	· **Established plantings ONLY.** · PRE – Apply on established raspberry plantings in late fall or late winter. · Apply the high rate of 175 kg/ha ONLY every other year. · Apply to cool moist but unfrozen soil before weeds emerge. · Do NOT apply if air temperatures are above 10°C–15°C to avoid injury from volatilization. · 70 g applied to an area 2×2 m is equivalent to 175 kg/ha (70 kg/acre). · Do NOT use on light, sandy soil. · Do NOT cultivate or work into the soil. · Do NOT apply within 100 days of harvest.
napropamide (4.5 kg/ha)	DEVRINOL DF (50 DF)	9 kg/ha (3.6 kg/acre)	· **New and established plantings.** · PRE – Apply **ONLY** once per season, either in the fall or spring, before weeds emerge. · Incorporation by rainfall or irrigation is essential. · **Do NOT** apply to frozen ground. · Avoid contact with fruit or foliage.
	DEVRINOL DF-XT (50 DF-XT)		
simazine (1.8–2.25 kg/ha)	PRINCEP NINE-T (90 WG)	2–2.5 kg/ha (0.8–1 kg/acre)	· **Established plantings ONLY.** · PRE – Apply in 300–1,000 L/ha (120–400 L/acre) water before weed emergence. · Apply as a directed spray at the base of the canes early in the spring before the weeds emerge. · Use lower rates for coarse, sandy soil. · Use higher rates for clay or higher organic matter soil. · Keep spray off young shoots. · **Do NOT** use in first year plantings. · **Do NOT** apply if a heavy rainfall is expected.
	SIMADEX (500 g/L)	3.6–4.5 L/ha (1.44–1.8 L/acre)	
	SIMAZINE 480 (480 g/L)	3.8–4.7 L/ha (1.52–1.88 L/acre)	

TABLE 14–3. Herbicide Treatment Rates for Berry Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 33 and Chapter 5, Notes on Adjuvants, page 85.
RASPBERRIES (cont'd)			
Soil Applied Grass and Broadleaf Herbicides (cont'd)			
terbacil (0.33–0.67 kg/ha) + napropamide (0.04 kg/ha)	SINBAR (80 WP or 80 WDG) + DEVRINOL DF (50 DF) + DEVRINOL DF-XT (50 DF-XT) L	0.41–0.84 kg/ha (0.16–0.34 kg/acre) + 4 kg/ha	• **Established plantings ONLY.** • Use only in plantings established in the field for at least 1 year. • For best results, apply SINBAR before weeds emerge or apply to weeds that are less than 5 cm tall. • Apply in a minimum of 200 L/ha (80 L/acre) water. • Make **ONLY** 1 application per year. • Apply below the canes in the fall, or in early spring before the fruitset. • Use **ONLY** on soil with 8%–10% organic matter. • Postemergent foliar uptake will be needed in situations of high organic soils. The product will be ineffective as a soil applied herbicide in this situation. • **Do NOT** spray on crop foliage. • **Do NOT** spray on exposed subsoil or roots. • **Do NOT** apply to weak or diseased plants. • **Do NOT** harvest within 70 days of application. • Injury may occur on sandy soil even with the low rate.
Postemergence Grass Herbicides			
sethoxydim (0.14–0.5 kg/ha) + surfactant/solvent (0.25–2 L/ha)	POAST ULTRA (450 g/L) + MERGE	0.32–1.1 L/ha (0.13–0.44 L/acre) + 0.25–2 L/ha (0.1–0.8 L/acre)	• **Established plantings ONLY.** • Apply to actively growing grasses. • For annual grass, use 0.32 L/ha (0.13 L/acre). Apply at the 1–6 leaf stage (2–5 is optimum). • For volunteer grains, use 0.47 L/ha (0.19 L/acre). Apply at the 1–6 leaf stage (2–5 is optimum). • For quackgrass, use 1.1 L/ha (0.44 L/acre). Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days. Use the high rate of MERGE for quackgrass. • Grasses emerging after application will not be controlled. • Use 100–200 L/ha (40–80 L/acre) water. • Spray tips angled forward 45° will give better coverage. • **Do NOT** use flood jet or hollow cone nozzles. • **Do NOT** apply if rain is expected within 1 h after application. • **Do NOT** apply closer than 37 days to harvest.
fluazifop-p-butyl (0.075–0.25 kg/ha)	VENTURE L (125 g/L)	0.6–2 L/ha (0.24–0.8 L/acre)	• **New and established plantings.** • New Plantings – Apply POST at the 2–6 leaf stage. • Established Plantings – Apply POST in early spring at prebloom stage to actively growing grasses before tillering or apply in the fall (August to October) and again in the spring. • Apply at 0.6 L/ha (0.24 L/acre) at 2–5 leaf stage of volunteer corn. • Apply at 0.8 L/ha (0.32 L/acre) at 2–5 leaf stage of volunteer wheat and barley. • Apply at 1 L/ha (0.4 L/acre) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails). • Apply at 2 L/ha (0.8 L/acre) at 3–5 leaf stage of quackgrass and wirestem muhly. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days. • **Do NOT** apply closer than 30 days to harvest.

TABLE 14–3. Herbicide Treatment Rates for Berry Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 33 and Chapter 5, Notes on Adjuvants, page 85.
RASPBERRIES (cont'd)			
Postemergence Broadleaf Herbicides			
2,4-D (0.55 kg/ha)	2,4-D (470 g/L)	1.2 L/ha (0.48 L/acre)	· **New and established plantings.** · Use the amine formulation. · Apply in 100–200 L/ha (40–80 L/acre) water. · **Do NOT** spray when plants are in bloom. · Keep spray off new shoots as much as possible. · Spot spraying at a rate equivalent to 1 kg ai/ha (0.4 kg ai/acre) may be necessary to control established dandelions and other broadleaf weeds.
	2,4-D (564 g/L)	0.92 L/ha (0.37 L/acre)	
	2,4-D (660 g/L)	0.83 L/ha (0.33 L/acre)	
Non-Selective Herbicides and Tank-Mix Options			
paraquat (1.1 kg/ha)	GRAMOXONE (200 g/L)	5.5 L/ha (2.2 L/acre)	· **New and established plantings.** · Apply in 1,000 L/ha (400 L/acre) water. · For spot spraying, apply 55 mL GRAMOXONE/10 L water sprayed to wet weed foliage. · Direct spray at base of canes in the spring before new shoots emerge or in the fall when canes are mature.
paraquat (1 kg/ha) + simazine (1.8–2.25 kg/ha)	GRAMOXONE (200 g/L) + PRINCEP NINE-T (90 WG)	5 L/ha (2 L/acre) + 2–2.5 kg/ha (0.8–1 kg/acre)	· **Established plantings ONLY.** · For emerged weeds with residual control of germinating weeds. · Apply as a directed spray to established plantings. · **Do NOT** spray young raspberry shoots. · Use 1,000 L/ha (400 L/acre) water to wet weed foliage. · Use lower rates for coarse, sandy soil. · Use higher rates for clay or higher organic matter soil. · **Do NOT** apply if a heavy rainfall is expected.
glufosinate ammonium (1 kg/ha)	IGNITE (150 g/L)	6.67 L/ha (2.7 L/acre)	· **Established plantings ONLY.** · For use in the production year of raspberries grown in the biennial production system, or in a planting that will be removed after harvest. · **Do NOT** apply to immature and weak plantings. · Apply when shoots are 10–20 cm tall to suppress the emerged flush of primocanes, and control any weeds emerged at time of treatment. · Apply in a minimum of 330 L/ha (132 L/acre) water. · Avoid drift onto green tissue of floricanes.

TABLE 14–3. Herbicide Treatment Rates for Berry Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 33 and Chapter 5, Notes on Adjuvants, page 85.
STRAWBERRIES			
Cultural Weed Control – See notes on Cultural Weed Control in Berry Crops, page 327. Use straw mulch that is free of weed seeds to avoid importing weeds into the field. The mulch should be spread between the rows when it is pulled off the plants in the spring to provide additional weed control.			
Rates per hectare or per acre refer to area actually treated with herbicide. **CAUTION:** DEVRINOL and SINBAR residues, high enough to harm many crops, may persist for several years after removal of a planting.			
Site Preparation Before Planting – See Chapter 6, Preplant & Postharvest Weed Control, page 91.			
Soil Applied Grass and Broadleaf Herbicides			
flumioxazin (0.11 kg/ha)	CHATEAU WDG (51.1%)	0.21 kg/ha (0.08 kg/acre)	· Apply **ONCE** per season as a broadcast spray to dormant plants or as a row middle spray using a shielded sprayer to non-dormant plants. · Broadcast applications may be made to dormant strawberries. · Apply prior to weed emergence. · Apply to coarse and medium textured soils with less than 5% organic matter. · Apply using ground application **ONLY.** · **Do NOT** apply after fruit set. · **Do NOT** allow spray drift to come in contact with fruit or foliage. · **Do NOT** apply through irrigation equipment. After use, tanks and nozzles.must be cleaned with a 3% ammonia solution. Please review label for more detailed instructions.
chlorthal dimethyl (6.75–10.125 kg/ha)	DACTHAL W-75 (75 WP)	9–13.5 kg/ha (3.6–5.4 kg/acre)	· **Planting year, 2–4 weeks after planting.** · **Planting year, late summer/fall (around Labour Day).** · **Harvesting year, spring immediately after mulch removal.** · PRE – Before weed emergence. · Apply the higher rate to transplants. · Shallow cultivation to incorporate herbicide into the soil surface may improve weed control. · **Do NOT** use on muck soils.
napropamide (4.5 kg/ha)	DEVRINOL DF (50 DF) DEVRINOL DF-XT (50 DF-XT)	9 kg/ha (3.6 kg/acre)	· **Planting year, 2–4 weeks after planting.** · **Planting year, late summer/fall (around Labour Day).** · **Planting year, late fall.** · **Harvesting year, spring after mulch removal.** · **Harvesting year, late summer/fall (around Labour Day).** · **Harvesting year, late fall.** · PRE – Apply once per season before weeds emerge or following cultivation. · Incorporation by rainfall, irrigation or cultivation is essential. · Where daughter plant establishment is important, (e.g., for plant producers) delay application until the desired number of daughter plants have been established. · Inhibition of daughter plant roots can occur where soil moisture is low and will be minimized if irrigation is applied shortly after application.

TABLE 14–3. Herbicide Treatment Rates for Berry Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 33 and Chapter 5, Notes on Adjuvants, page 85.
STRAWBERRIES (cont'd)			
Soil Applied Grass and Broadleaf Herbicides (cont'd)			
s-metolachlor/benoxacor (1.14–1.6 kg/ha)	DUAL II MAGNUM (915 g/L)	1.25–1.75 L/ha (0.5–0.7 L/acre)	· **Planting year, before planting.** · **Bearing years: After mulch removal but before weed emergence.** · PPI or PRE – Apply and incorporate, or apply post-transplanting before weeds emerge. · Apply **ONLY** once per year. · Apply by ground application equipment **ONLY.** · Initial injury may occur but will be outgrown with no reduction in yield. · Apply in 150 L/ha water. · **Do NOT** harvest berries within 30 days of application · **Do NOT** apply to cultivar Joliette. · Incorporation is required for nutsedge control. Nutsedge control may be limited during extended periods of dry hot weather following application. · Use the higher application rate for heavier weed problems.
oxyfluorfen (0.24 kg/ha)	GOAL 2XL (240 g/L)	1.0 L/ha (0.4 L/acre)	· **Planting year, late fall.** · **Harvesting year, late fall.** · PRE – Before weed emergence. · Apply in 500 L/ha (250 L/acre) spray solution. · Apply **ONLY** once per year as a ground application. · Apply to dormant plants before applying mulch in late fall. · For control of labeled weeds plus field pansy and wood sorrel (oxalis). · **Do NOT** apply within 150 days of harvest.
terbacil (0.56–0.68 kg/ha)	SINBAR (80 WP) SINBAR (80 WDG)	0.7–0.85 kg/ha (0.28–0.34 kg/acre)	· **Planting year, late fall.** · **Harvesting year, renovation.** · **Harvesting year, late fall.** · PRE – Apply to a weed-free soil surface just before mulching. · Apply in at least 300 L/ha (120 L/acre) water. · Use low rate where it is planned to use SINBAR again in the spring. · Use lower rate on sandy soils low in organic matter. · Use lower rate on sensitive varieties such as Annapolis, Bounty, Cavendish, Glosscap, Kent, Micmac, Mira and Wendy since they may be severely injured. · **Do NOT** apply to weak or diseased plants of any variety. · **Do NOT** overlap spray swaths.

TABLE 14–3. Herbicide Treatment Rates for Berry Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 33 and Chapter 5, Notes on Adjuvants, page 85.
STRAWBERRIES (cont'd)			
Soil Applied Grass and Broadleaf Herbicides (cont'd)			
terbacil (0.22–0.44 kg/ha)	SINBAR (80 WP)	0.28–0.55 kg/ha (0.11–0.22 kg/acre)	· **Planting year, 4–6 weeks after planting.** · **Planting year, late summer/fall (around Labour Day).** · **Harvesting year, spring after mulch removal.** · **Harvesting year, late summer/fall (around Labour Day).** · PRE – Apply before weeds emerge or to very small weeds. · Apply when mother plants are well established but before runnering becomes extensive and new runner plants are rooting. · Apply in at least 300 L/ha (120 L/acre) water. · Use lower rate on sandy soils low in organic matter. · Use lower rate on sensitive varieties such as Kent, Bounty, Micmac, Annapolis, Glooscap and Cavendish since they may be severely injured at higher rates. · **Do NOT** apply to weak or diseased plants of any variety. · **Do NOT** overlap spray swaths. · Shallow cultivation can be done to train runners and control escaped weeds without destroying the effectiveness of the herbicide.
	SINBAR (80 WDG)		
trifluralin (0.6–1.15 kg/ha)	TREFLAN EC (480 g/L)	1.2–2.4 L/ha (0.48–0.96 L/acre)	· **Planting year ONLY.** · PPI – Apply to weed-free soil and incorporate immediately in two directions. · May be applied and incorporated 1 day to 3 weeks before planting. · May delay establishment under stressful conditions.
	RIVAL EC (500 g/L)	1.2–2.2 L/ha (0.48–0.88 L/acre)	
	BONANZA 480 (480 g/L)	1.25–2.3 L/ha (0.5–0.92. L/acre)	
Postemergence Grass Herbicides			
sethoxydim (0.14–0.5 kg/ha)	POAST ULTRA (450 g/L)	0.32–1.1 L/ha (0.13–0.44 L/acre)	· **Planting year, 2–6 weeks after planting.** · **Planting year, late summer/fall (around Labour Day).** · **Harvesting year, spring after mulch removal.** · **Harvesting year, renovation.** · **Harvesting year, late summer/fall (around Labour Day).** · Apply to actively growing grasses. · For annual grass, use 0.32 L/ha (0.13 L/acre). Apply at the 1–6 leaf stage (2–5 is optimum). · For volunteer grains, use 0.47 L/ha (0.19 L/acre). Apply at the 1–6 leaf stage (2–5 is optimum). · For quackgrass, use 1.1 L/ha (0.44 L/acre). Apply up to the 3 leaf stage. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days. Use the high rate of MERGE for quackgrass. · Use 100–200 L/ha (40–80 L/acre) water. · Grasses emerging after application will not be controlled. · Spray tips angled forward 45° will give better coverage. · **Do NOT** use flood jet or hollow cone nozzles. · **Do NOT** apply if rain is expected within 1 h after application. · **Do NOT** apply closer than 25 days to harvest. · Wait at least 4 days after application before applying SINBAR.
+ surfactant/solvent (0.25–2 L/ha)	+ MERGE	0.25–2 L/ha (0.1–0.8 L/acre)	

TABLE 14–3. Herbicide Treatment Rates for Berry Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 33 and Chapter 5, Notes on Adjuvants, page 85.
STRAWBERRIES (cont'd)			
Postemergence Grass Herbicides (cont'd)			
fluazifop-p-butyl (0.075–0.25 kg/ha)	VENTURE L (125 g/L)	0.6–2 L/ha (0.24–0.8 L/acre)	· **Planting year, 2–6 weeks after planting.** · **Planting year, late summer/fall (around Labour Day).** · **Harvesting year, spring after mulch removal.** · **Harvesting year, renovation.** · **Harvesting year, late summer/fall (around Labour Day).** · Apply POST to actively growing grasses before tillering. · Apply at 0.6 L/ha (0.24 L/acre) at 2–5 leaf stage of volunteer corn. · Apply at 0.8 L/ha (0.32 L/acre) at 2–5 leaf stage of volunteer wheat and barley. · Apply at 1 L/ha (0.4 L/acre) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails). · Apply at 2 L/ha (0.8 L/acre) at 3–5 leaf stage of quackgrass and wirestem muhly. Thorough preplant tillage will ensure more uniform quackgrass emergence. Cultivate after 7 days. · Use **ONLY** 1 application per season. · Wait at least 14 days after application before applying SINBAR.
Postemergence Broadleaf Herbicides			
2,4-D (0.55 kg/ha)	2,4-D (470 g/L)	1.17 L/ha (0.47 L/acre)	· **Planting year, 2–6 weeks after planting.** · Use the amine formulation. · Apply in 100–200 L/ha (40–80 L/acre) water. · Use low pressure and a coarse spray to minimize risk of spray drift to susceptible crops. · **Do NOT** use while early runners are rooting. · **Do NOT** use between mid-August and fall dormancy when flower buds are developing for next year's crop.
	2,4-D (564 g/L)	0.95 L/ha (0.38 L/acre)	
	2,4-D (660 g/L)	0.83 L/ha (0.34 L/acre)	
2,4-D (1.034 kg/ha)	2,4-D (470 g/L)	2.2 L/ha (0.88 L/acre)	· **Harvesting year, renovation.** · Apply after harvest but before mowing to control dandelions and other broadleaf perennials. Delay mowing for a few days after application. · Use the amine formulation. · **Do NOT** apply 2,4-D between mid August and fall dormancy when strawberries are initiating flower buds. · Some cultivars like Veestar are more sensitive to 2,4-D.
	2,4-D (564 g/L)	1.7 L/ha (0.68 L/acre)	
	2,4-D (660 g/L)	1.57 L/ha (0.63 L/acre)	

TABLE 14–3. Herbicide Treatment Rates for Berry Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 33 and Chapter 5, Notes on Adjuvants, page 85.
STRAWBERRIES (cont'd)			
Postemergence Broadleaf Herbicides (cont'd)			
carfentrazone-ethyl (8.8–28.1 g/ha) + non-ionic surfactant (0.25% v/v)	AIM EC (240 g/L) + AGRAL 90	36.5–117 mL/ha (14.8–47 mL/acre) + 2.5 L/1,000 L	· **Planting year, 2–4 weeks after planting.** · Apply POST with a hooded sprayer between the rows or between the plastic mulch. · Apply to actively growing weeds up to 10 cm tall. · Apply in a minimum of 100 L/ha (40 L/acre) water. · **Do NOT** apply closer than 1 day to harvest. · Apply **ONLY** once per growing season. · Injury may result if the spray is allowed to come in contact with the green stem, leaves, bloom or fruit.
	AIM EC (240 g/L) + AG-SURF		
carfentrazone-ethyl (8.8–28.1 g/ha) + surfactant/solvent (0.1% v/v)	AIM EC (240 g/L) + MERGE	36.5–117 mL/ha (14.8–47 mL/acre) + 1 L/1,000 L	
phenmedipham/ desmedipham (0.18–0.28 kg/ha)	BETAMIX B ((1:1) 206 g/L)	1.15–1.75 L/ha (0.47–0.71 L/acre)	· May be applied to June-bearing strawberry varieties only in the year of planting as a post-transplant application. · The first application must be applied when the earliest weeds have reached the cotyledon stage. Repeat applications at 5 to 7 day intervals following the first application or when another flush of weeds germinates. · Apply a maximum of 3 applications per season and do not harvest any berries that might develop in the year of planting.
clopyralid (0.2–0.3 kg/ha)	LONTREL 360 (360 g/L)	0.56–0.83 L/ha (0.22–0.33 L/acre)	· **Harvesting year ONLY, renovation.** · To control tufted vetch, Canada thistle, sheep sorrel and ox-eye daisy. · Apply immediately after harvest at renovation, 7–10 days before mowing. · Apply with a boom sprayer in 150–250 L/ha (60–100 L/acre) water. · Apply once per year as a single treatment. · Early cultivars like Veestar or Annapolis may be more susceptible to injury. · Certain environmental stresses such as drought, flooding or severe overwintering conditions may increase the risk of injury. · **Do NOT** apply closer than 200 days to harvest.

TABLE 14–3. Herbicide Treatment Rates for Berry Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 33 and Chapter 5, Notes on Adjuvants, page 85.
STRAWBERRIES (cont'd)			
Non-Selective Herbicides			
glyphosate (0.36 kg/2 L)	glyphosate (360 g/L)*	1 L/2 L water	· **Planting year, 2–6 weeks after planting.** · **Planting year, late summer/fall (around Labour Day).** · **Harvesting year, spring after mulch removal.** · **Harvesting year, renovation.** · **Harvesting year, late summer/fall (around Labour Day).** · Apply with a rope wick or other similar device when weeds are 15 cm above the crop. · Avoid contact with the strawberry plants. · **Do NOT** apply when weeds are wet. · See Wick Wiper and Roller Application, page 100. * See Table 4–1. Herbicides Used in Ontario, page 30 for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.
	glyphosate (480 g/L)*	0.75 L/2 L of water	
	glyphosate (500 g/L)*	0.72 L/2 L of water	
	glyphosate (540 g/L)*	0.67 L/2 L of water	
glyphosate (0.36–0.72 kg/100 L)	glyphosate (360 g/L)*	1–2 L/100 L water	· **Planting year, 2–6 weeks after planting.** · **Planting year, late summer/fall (around Labour Day).** · **Harvesting year, spring after mulch removal.** · **Harvesting year, renovation.** · **Harvesting year, late summer/fall (around Labour Day).** · Use hand held sprayers as a spot treatment if wiper equipment is not available. · Avoid contact with strawberry plant, crop in the treated area will be killed. · **Do NOT** apply closer than 30 days before harvest. * See Table 4–1. Herbicides Used in Ontario, page 30, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.
	glyphosate (480 g/L)*	0.75–1.5 L/100 L water	
	glyphosate (500 g/L)*	0.72–1.44 L/100 L water	
	glyphosate (540 g/L)*	0.67–1.34 L/100 L water	
paraquat (1.1 kg/ha)	GRAMOXONE (200 g/L)	5.5 L/ha (2.2 L/acre)	· **Planting year, late summer/fall (around Labour Day).** · **Harvesting year, renovation.** · **Harvesting year, late summer/fall (around Labour Day).** · Apply to remove weeds between narrow strawberry rows. · Apply in 550–1,100 L/ha (220–440 L/acre) water. · Apply on a calm day. · Use shields with low pressure and a spray nozzle arrangement to avoid drift. · Complete coverage is important. Use higher water volumes on dense vegetation. · Perennial weeds will only be suppressed. · Only emerged weeds will be controlled.

15. TREE FRUIT, TREE NUTS & GRAPES

NOTES: Weed control ratings are given as 0–9 where 0 indicates no control and 9 indicates 90%–100% control under ideal conditions. Ratings are subjective values based on best available information and give general comparisons based on use as described in this guide. Under unfavorable conditions (e.g., too dry, too wet, too cold or poor application) the herbicides may not be as effective as indicated. Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used. Please refer to product label for more information on registered weed species, product uses and precautions.

TABLE 15–1. Tree Fruit & Grape Weed Control Ratings

LEGEND: Numbers (0–9) = weed control ratings – = insufficient information available to make a rating ✓ = can be used on this crop x = not indicated for use on this crop
* = Refer to product label for list of species controlled

	Crop Registrations						**Annual Grasses**						**Annual Broadleaves**						**Perennial Weeds**																	
Trade Name	**apples**	**apricots**	**cherries/plums**	**grapes**	**peaches**	**pears**	**barnyard grass**	**crabgrass**	**fall panicum**	**foxtails**	**witchgrass**	**sandbur**	**chickweed, common**	**lady's-thumb**	**lamb's-quarters**	**mustards**	**pigweed**	**ragweed**	**bindweed, field**	**chickweed, mouse-eared**	**dandelion**	**goldenrod**	**grape, wild**	**ground-ivy (creeping charlie)**	**mallow**	**milkweed**	**nightshade, climbing**	**nutsedge**	**plantains**	**poison-ivy**	**quackgrass**	**sow-thistle**	**stinging nettle**	**thistle, Canada**	**vetches**	**virginia creeper**
Soil Applied Broadleaf Herbicides																																				
SANDEA	✓	x	x	x	x	x	0	0	0	0	0	0	8	8	8	8	8	8[6]	6	–	–	–	–	–	8	–	–	6	8	–	–	–	–	–	–	–
Soil Applied Grass and Broadleaf Herbicides																																				
ALION	✓	✓	✓	✓	✓	✓	9	9	–	9	9	–	–	9	9	9	6	–	9	9	7	7	–	–	–	–	–	–	–	–	–	–	–	–	–	–
CASORON	✓	x	✓	✓	✓	✓	7	6	6	6	7	–	8	7	8	3	8	4	7	7	7	–	5	6	–	–	–	7	7	5	7	7	–	7	7	–
CHATEAU	✓	✓	✓	✓	✓	✓	3	3	3	5	3	–	–	7	9	–	9	7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
DEVRINOL	✓	✓	x	✓	✓	✓	8	9	8	8	8	8	7	6	8	5	8	7	–	–	5	–	–	–	–	5	–	5	5	1	5	5	–	5	1	–
DUAL II MAGNUM	✓	✓	✓	x	x	✓	9	9	8	9	9	–	6	2	7	2	8	4	0	–	5	–	–	–	–	0	–	8	5	–	0	0	0	0	0	0
FRONTIER MAX	x	x	x	✓	x	x	9	9	8	9	9	4	–	2	7	2	8	4	0	–	–	–	–	–	–	0	–	8	–	–	0	0	0	0	0	0
KARMEX	x	x	x	✓	x	x	9	5	5	5	8	–	9	9	9	9	8	9	–	–	5	–	–	–	–	5	–	5	–	–	5	5	–	5	–	–
Soil Applied Grass and Broadleaf Herbicides (cont'd)																																				

[1] For cherries only.
[2] Non-bearing trees only.
[3] Hooded sprayer application only.
[4] Top growth only; regrowth can be expected.
[5] Use higher rates when larger than 15 cm tall or across.
[6] Registered for preemergent activity on common ragweed only.
[7] Weeds cannot be emerged at time of application to achieve this level of control.
[8] Various formulations available, see Table 4–1. Herbicides Used in Ontario, page 30.

TABLE 15–1. Tree Fruit & Grape Weed Control Ratings (cont'd)

LEGEND: Numbers (0–9) = weed control ratings – = insufficient information available to make a rating ✓ = can be used on this crop x = not indicated for use on this crop
* = Refer to product label for list of species controlled

	Crop Registrations						Annual Grasses						Annual Broadleaves						Perennial Weeds																	
Trade Name	apples	apricots	cherries/plums	grapes	peaches	pears	barnyard grass	crabgrass	fall panicum	foxtails	witchgrass	sandbur	chickweed, common	lady's-thumb	lamb's-quarters	mustards	pigweeds	ragweed	bindweed, field	chickweed, mouse-eared	dandelion	goldenrod	grape, wild	ground-ivy (creeping charlie)	mallow	milkweed	nightshade, climbing	nutsedge	plantains	poison-ivy	quackgrass	sow-thistle	stinging nettle	thistle, Canada	vetches	virginia creeper
KERB	✓	x	x	x	x	✓	8	7	8	8	9	8	9	7	9	8	9	7	–	–	–	–	–	–	–	6	–	6	–	–	6	6	–	–	–	–
LEXONE	✓	✓	✓[1]	x	✓	✓	8	8	9	9	9	–	9	9	9	9	8	8	–	8	6	2	2	2	2	6	2	6	8	2	6	2	2	6	2	0
LOROX	✓	x	✓	x	✓	✓	7	6	5	8	9	–	9	7	9	7	8	8	5	8	–	–	–	–	–	5	–	8	–	–	7	8	–	7	–	–
PRINCEP NINE-T **or** SIMADEX **or** SIMAZINE 480	✓	✓	x	✓	✓	✓	8	8	6	8	8	–	8	9	9	9	9	8	2	–	5	–	–	–	–	0	–	5	–	–	6	5	–	5	0	–
SENCOR	✓	✓	✓[1]	x	✓	✓	7	8	9	8	9	–	9	9	9	9	8	8	2	–	–	–	–	–	–	2	2	2	–	–	2	2	–	2	2	0
SINBAR	✓	✓[2]	✓[2]	x	✓	✓[2]	8	7	8	8	8	5	9	7	8	8	7	7	6	8	6	–	–	–	–	6	–	6	8	–	6	1	–	6	1	–
TREFLAN	✓[2]	✓[2]	✓[2]	x	✓[2]	✓[2]	9	9	8	8	8	–	7	6	8	3	8	4	2	–	2	1	1	1	0	2	2	–	2	0	2	2	2	2	2	0
Soil Applied Grass and Broadleaf Tank-mixes																																				
DEVRINOL + PRINCEP NINE-T	✓[2]	✓[2]	✓[2]	x	✓[2]	✓[2]	8	9	8	8	8	8	7	9	9	9	9	8	2	–	5	2	2	2	2	5	2	5	5	1	6	5	2	5	1	0
DEVRINOL + SINBAR	✓[2]	✓[2]	✓[2]	x	✓[2]	✓[2]	8	9	8	8	8	8	9	7	8	8	8	7	6	–	6	2	2	2	2	6	2	6	8	1	6	5	2	6	1	0
DUAL II MAGNUM + LEXONE	✓	✓	✓	x	✓	✓	9	9	9	9	9	–	9	9	9	9	8	8	2	–	5	–	–	–	–	2	2	8	–	–	2	2	2	2	2	0
DUAL II MAGNUM + PRINCEP NINE-T	✓	✓	✓	x	x	✓	9	9	9	9	9	–	9	9	9	9	8	8	2	–	5	–	–	–	–	0	–	8	–	–	6	5	–	5	0	–
SENCOR + TREFLAN	✓[2]	✓[2]	✓[2]	x	✓[2]	✓[2]	8	8	9	9	9	–	9	9	9	9	8	8	2	–	2	1	1	1	0	2	2	2	2	0	2	2	2	2	2	0
Postemergence Grass Herbicides																																				

[1] For cherries only.
[2] Non-bearing trees only.
[3] Hooded sprayer application only.
[4] Top growth only; regrowth can be expected.
[5] Use higher rates when larger than 15 cm tall or across.
[6] Registered for preemergent activity on common ragweed only.
[7] Weeds cannot be emerged at time of application to achieve this level of control.
[8] Various formulations available, see Table 4–1. Herbicides Used in Ontario, page 30.

TABLE 15–1. Tree Fruit & Grape Weed Control Ratings (cont'd)

LEGEND: Numbers (0–9) = weed control ratings – = insufficient information available to make a rating ✓ = can be used on this crop x = not indicated for use on this crop
* = Refer to product label for list of species controlled

	Crop Registrations						Annual Grasses						Annual Broadleaves						Perennial Weeds																	
Trade Name	apples	apricots	cherries/plums	grapes	peaches	pears	barnyard grass	crabgrass	fall panicum	foxtails	witchgrass	sandbur	chickweed, common	lady's-thumb	lamb's-quarters	mustards	pigweeds	ragweed	bindweed, field	chickweed, mouse-eared	dandelion	goldenrod	grape, wild	ground-ivy (creeping charlie)	mallow	milkweed	nightshade, climbing	nutsedge	plantains	poison-ivy	quackgrass	sow-thistle	stinging nettle	thistle, Canada	vetches	virginia creeper
POAST ULTRA	✓	✓	✓	✓	✓	✓	8	8	9	8	9	–	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	6	0	0	0	0	0
VENTURE L	✓	✓	✓	✓	✓	✓	9	9	9	9	9	–	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	7	0	0	0	0	0
Postemergence Broadleaf Herbicides																																				
AIM EC (Hooded Sprayer)	✓[3]	✓[3]	✓[3]	✓[3]	✓[3]	✓[3]	–	–	–	–	–	–	–	–	8	8	8	–	–	–	–	–	–	–	8	–	8	–	–	–	–	–	–	–	–	–
BASAGRAN	✓[2]	✓[2]	✓[2]	x	✓[2]	✓[2]	0	0	0	0	0	0	8	9	7	8	8	8	7	–	–	–	–	–	–	5	2	8[4]	2	–	2	5	8[4]	6	5	–
LONTREL	✓	✓	✓	x	✓	x	0	0	0	0	0	0	–	–	–	–	–	8	–	–	–	–	–	–	–	–	–	–	–	–	–	8[4]	–	8[4]	9	–
SANDEA	✓	x	x	x	x	x	0	0	0	0	0	0	8	8[7]	8[7]	8	8	8	6	–	–	–	–	–	8	7	–	9	8	–	–	–	–	–	–	–
2,4-D[8]	✓	✓	✓	x	✓	✓	0	0	0	0	0	–	7	4	8	9	9	8	5	2	8	2	5	2	2	2	–	2	8	–	2	6	–	8	5	–
Postemergence Grass and Broadleaf Herbicides																																				
GLYPHOSATE[8]	✓	✓	✓	✓	✓	✓	9	9	9	9	9	–	9	9	9	9	9	9	8	9	8/9[5]	–	8	5	5	9	–	5	9	9	9	9	5	9	5[4]	8[4]
GRAMOXONE	✓	✓	✓	✓	✓	✓	9	9	9	9	9	–	9	9	9	9	9	9	8[4]	8[4]	8[4]	8[4]	8[4]	8[4]	8[4]	8[4]	8[4]	8[4]	8[4]	8[4]	8[4]	8[4]	8[4]	8[4]	8[4]	8[4]
GRAMOXONE + DEVRINOL	✓	x	x	✓	x	✓	9	9	9	9	9	–	9	9	9	9	9	9	8[4]	8[4]	8[4]	8[4]	8[4]	8[4]	8[4]	8[4]	8[4]	8[4]	8[4]	8[4]	8[4]	8[4]	8[4]	8[4]	8[4]	8[4]
IGNITE	✓	✓	✓	✓	✓	x	9	9	9	9	9	–	9	9	9	8	9	9	8[4]	8[4]	8[4]	8[4]	8[4]	8[4]	8[4]	8[4]	8[4]	8[4]	8[4]	8[4]	5	9	8[4]	8[4]	8[4]	8[4]
Other Tank-Mix Options																																				
ALION + GLYPHOSATE[8]	✓	✓	✓	✓	✓	✓	9	9	9	9	9	–	9	9	9	9	9	9	8	9	8/9[5]	7	8	5	5	9	–	5	9	9	9	9	5	9	5[4]	8[4]
ALION + IGNITE	✓	✓	✓	✓	✓	✓	9	9	–	9	9	–	–	9	9	9	6	–	9	9	8[4]	8[4]	8[4]	8[4]	8[4]	8[4]	8[4]	8[4]	8[4]	8[4]	5	9	8[4]	8[4]	8[4]	8[4]

[1] For cherries only.
[2] Non-bearing trees only.
[3] Hooded sprayer application only.
[4] Top growth only; regrowth can be expected.
[5] Use higher rates when larger than 15 cm tall or across.
[6] Registered for preemergent activity on common ragweed only.
[7] Weeds cannot be emerged at time of application to achieve this level of control.
[8] Various formulations available, see Table 4–1. Herbicides Used in Ontario, page 30.

Cultural Weed Control in Tree Fruit and Tree Nut Crops

A successful weed control program must integrate cultural and chemical weed control practices. Growers cannot depend entirely on chemical weed control in fruit and vine crops, since there is a limited spectrum of herbicides registered for these crops.

Perennial Weed Control

It is important to identify and control perennial weeds in the preplanting year. It is very difficult to control perennial weeds once a planting is established because of crop sensitivity to some herbicides and since it is not possible to clean cultivate in established orchards or vineyards.

Quackgrass, bindweed, vetch, wild grape, perennial nightshade, thistles, ground-ivy (creeping charlie) and burdock are perennial weeds that present serious problems in these crops.

Systemic herbicides such as glyphosate should be applied to perennial weeds in the preplanting year. Consult the product label and be sure to use the recommended rate for the weed in question. Apply the herbicide at the proper stage of growth of the weed, otherwise only temporary control will be achieved. Repeated cultivations of some perennial weeds such as bindweed will also provide control.

Site Preparation

A green manure crop such as perennial rye-grass or Sudan grass should be established in the preplanting year following or in conjunction with measures to control perennial weeds. This crop will provide competition to reduce weed growth as well as improving the soil structure. Non-selective herbicides can be applied before planting the green manure crop and before plowing it under. Short residual selective herbicides such as 2,4-D may be used with the green manure crop, but avoid using herbicides that leave a soil residue that will carry over into the planting year. See Chapter 6, *Preplant – Site Preparation Prior to any Crop*, page 95.

Mulching

A biodegradable plastic mulch could be used for weed control in the planting strip. Mulch will also assist in weed control beneath the trees or in the planting strip if it is applied early in the season before the weed seeds germinate. Use mulch that is free of weed seeds and ensure that enough nitrogen is provided for the plants. The mulch should be pulled away from around the tree bases for winter rodent protection. Peastone gravel is another option that can be applied around the base of the trees. The gravel will provide weed control, as well as, improve drainage, encourage deeper rooting and discourage rodents.

Reducing Weed Pressure

Cultivation can provide weed control between the rows. Alternatively, a vigorous sod between the rows will prevent weeds from becoming established. It is better to seed a fescue sod rather than rely on a natural sod composed of weed and grass species because the weeds will seed into the orchard or vine row.

Prevent weeds from setting seed in adjacent uncropped areas by using cultural or chemical weed control measures. Mowing at regular intervals will prevent many weeds from flowering. Try to control weeds that escape before they set seed by cultural removal or chemical mowing. In some situations, tools such as a weed whip may be of use. Mowers are available which will cut close to the trees without injury. Mowing, however, will not eliminate weed competition.

Rotating Herbicide Families

(See Table 4–6. *Weed Populations Confirmed Resistant to Herbicide Groups in Ontario Counties*, page 78).

In perennial crops, rotation of herbicide families is important to minimize the build up of seed from weed escapes, including triazine tolerant weeds. Rotation will also help avoid an accumulation of herbicide residues in the soil that may result in crop injury over a period of years and may hinder replanting.

Herbicide Application Timings

Preplant (PP) Treatments

Preplant treatments are applied before the orchard or vineyard is planted. Some of these herbicides kill seedlings soon after germination while others also kill weed seeds. Most herbicides used for these treatments must be thoroughly incorporated into the soil by cultivation soon after application. Check the label. Also see Chapter 6, *Preplant & Postharvest Weed Control*, page 91 for details of products, rates and remarks.

Preplant (PP) Weed and Cover Crop Control

Control cover crops and emerged weeds before planting orchards or vineyards. Refer to Table 6–1. *Non-Selective Herbicides Available for Preplant Site Preparation*, page 91. Alternatively, a grower may choose to kill the cover crop and/or emerged weeds just before planting the orchard or vine crop and either till the area or leave the seedbed untilled.

Preplant Incorporated (PPI)

Two incorporations at right angles operating at a depth of 10 cm using a double disk (7–10 km/h) or vibrating shank S-tine cultivator (10–13 km/h) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Special attention should be directed toward machinery cleanliness and/or treating fields with perennial weeds last.

Preemergence (PRE)

Rainfall at 15–20 mm within 7–10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall. These materials prevent emergence of many weed seedlings without reducing crop stand. Apply immediately after seeding or at least before the emergence of the crop. If these materials are applied after weeds have emerged, kill is usually poor. Best results are obtained with this method when conditions for weed seed germination are good.

Postemergence (POST)

These chemicals are applied after the orchard or vineyard is planted. Applied as directed, the weeds can be killed without injury to the crop. Leaf stage of the weeds is critical for good weed control. Smaller weeds are generally easier to kill but there needs to be enough leaf surface to intercept the herbicide. Apply according to leaf stages specified on the pesticide label. Crop stage is important to optimize crop safety. Adjuvants will frequently improve the weed control when used as directed. Weather or other conditions may influence the optimum rate of adjuvant, see the product label for more details. Always use appropriate drift management technology.

Inter-Row Weeding

The herbicide is directed between the orchard and/or vineyard rows onto the emerged weeds. The herbicide is used as a rescue operation where other methods of weed control have failed. Use special low pressure (7–15 kPa) applicators such as dribble bars or vibra jets equipped with shields to prevent wetting the crop. See *Stale Seedbed and Inter-Row Weeding,* page 96.

Wiper Applicators for Selective Weed Control

Wiper applicators (rope-wick, roller applicator or similar device) have been extensively used with glyphosate. Check product labels for use of this application technique with other herbicides.

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
APPLES			
Site Preparation Before Planting – See Chapter 6, Preplant & Postharvest Weed Control, page 91.			
Rates per hectare or per acre refer to area actually treated with herbicide. Unless specified, apply all treatments in 150–300 L/ha (60–120 L/acre) water. **CAUTION** – simazine, DEVRINOL and SINBAR residues high enough to harm many crops may persist for several years after removal of orchard.			
Soil Applied Broadleaf Herbicides			
halosulfuron (25–51 g/ha) + non-ionic surfactant (0.2% v/v)	SANDEA (72.6 WG) + non-ionic surfactant	35–70 g/ha (14–28 g/acre) + 2.5 L/1,000 L	· **New, 1 year or more and established plantings ONLY** · Apply as a single or sequential application, allow a minimum of 21 days between applications · Do not apply more than 140 g/ha (56 g/acre) per season · Use a minimum water volume of 140 L/ha (56 L/ha). · Rains greater than 2.5 cm within 5–7 days of application may cause temporary yellowing and delay development of crop. · **Do NOT** contact green tissue such as foliage, fruit or green bark. · **Do NOT** spray over top of plastic mulch. · **Do NOT** harvest within 14 days after application.

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Soil Applied Grass and Broadleaf Herbicides			
indaziflam (0.075 kg/ha)	ALION 200 SC (200 g/L)	0.375 L/ha (0.152 L/acre)	· **Established plantings ONLY.** · PRE to weeds. Apply to soil before weeds germinate. If weeds have emerged, this product may be tank-mixed with a burndown herbicide (consult label for further instructions). · May be applied at anytime throughout the growing season when the ground is not frozen or snow covered. · Excessive crop or weed debris present on the soil surface at time of application may prevent uniform product distribution reaching the soil and result in reduced weed control. · Apply **ONLY** once per growing season. · Apply **ONLY** to crops that have been established for at least three full growing seasons.
dichlobenil (4.4–7 kg/ha)	CASORON G-4 (4 GR)	110–175 kg/ha (44–70 kg/acre)	· **Established plantings ONLY.** · PRE – Apply to cool, moist soil in spring before weeds emerge or after cultivation. · **Do NOT** apply if air temperatures are above 10°C–15°C to avoid injury from volatilization. · **Do NOT** apply until 4 weeks after transplanting. · **Do NOT** use on light sandy soils. · 70 g applied to an area 2×2 m is equivalent to 175 kg/ha (70 kg/acre).
flumioxazin (0.14–0.21 kg/ha)	CHATEAU WDG (51.1%)	0.28–0.42 kg/ha (0.11–0.17 kg/acre)	· **Established plantings ONLY.** · Maximum 2 applications per growing season at least 30 days apart. · Apply the lower rate to coarse textured soil with less than 5% organic matter and apply the higher rate to medium textured soil with less than 5% organic matter. · **Do NOT** apply within 100 m of non-dormant pears. · Apply using ground application only. · **Do NOT** apply to trees established less than 1 year. · **Do NOT** apply after bud break unless using hooded or shielded equipment. · After use, tanks and nozzles must be cleaned with a 3% ammonia solution. Please review label for more detailed instructions. · **Do NOT** harvest within 60 days of application.
s-metolachlor/ benoxacor (1.6 kg/ha)	DUAL II MAGNUM (915 g/L)	1.75 L/ha (0.7 L/acre)	· **New and established plantings.** · PRE – Apply once per year as a band treatment under the trees before weeds emerge. · Avoid contact with trunk and leaves of trees. · **Do NOT** use on sandy soil with less than 2% organic matter.
propyzamide (2.25 kg/ha)	KERB (50 WSP)	4.5 kg/ha (1.8 kg/acre)	· **Established plantings ONLY.** · PRE – Apply from late September to early November when soil is cool and moist but not frozen. · Use only under apple trees established at least 1 year. · 5 kg/ha is equivalent to 45 g/100 m².
napropamide (4.5 kg/ha)	DEVRINOL DF (50 DF)	9 kg/ha (3.6 kg/acre)	· **New and established plantings.** · PRE – Apply in the fall through early spring before weeds emerge, but not on frozen ground. · Avoid contact with fruit and foliage. · Use a directed spray at low pressure. · Incorporation by rainfall or irrigation is essential within 2 days of application. · **Do NOT** apply when fruit is on the ground during harvest.
	DEVRINOL DF-XT (50 DF-XT)		

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
APPLES (cont'd)			
Soil Applied Grass and Broadleaf Herbicides (cont'd)			
napropamide (3.5 kg/ha) + simazine (1.0–4.5 kg/ha)	DEVRINOL DF (50 DF) + PRINCEP NINE-T (90 WG) DEVRINOL DF-XT (50 DF-XT) + PRINCEP NINE-T (90 WG	7 kg/ha (2.8 kg/acre) + 1.1–5.0 kg/ha (0.44–2 kg/acre)	· Make **ONLY** 1 application in the planting year. · PRE – Apply in the fall through early spring before weeds emerge. · Apply the lower rate to trees established less than 1 year. · **Do NOT** apply to sandy soils that have organic matter less than 2%. · **Do NOT** apply on frozen ground or during harvest. · Avoid contact with trunk and leaves. · Incorporation by rainfall or irrigation is essential within 2 days of application.
napropamide (4.5 kg/ha) + terbacil (0.48 kg/ha)	DEVRINOL DF (50 DF) + SINBAR (80 WP) DEVRINOL DF (50 DF) + SINBAR (80 WDG) DEVRINOL DF-XT (50 DF-XT) + SINBAR (80 WP) DEVRINOL DF-XT (50 DF-XT) + SINBAR (80 WDG)	9 kg/ha (3.6 kg/acre) + 0.6 kg/ha (0.24 kg/acre)	· Make only 1 application in the planting year. · PRE – Apply in the fall through early spring before weeds emerge. · Incorporation by rainfall or irrigation is essential within 2 days of application. · **Do NOT** apply on frozen ground or during harvest.
s-metolachlor/ benoxacor (1.14–1.6 kg/ha) + simazine (0.99–4.5 kg/ha)	DUAL II MAGNUM (915 g/L) + PRINCEP NINE-T (90 WG)	1.25–1.75 L/ha (0.5–0.7 L/acre) + 1.1–5.0 kg/ha (0.44–2 kg/acre)	· **New and established plantings.** · PRE – Apply post-planting, once per year as a band treatment before weeds emerge, preferably after rain has settled the soil around the trees. · **Do NOT** use on sandy soils with less than 2% organic matter. · Avoid contact with tree trunks and leaves. · For established plantings use higher rates.
s-metolachlor/ benoxacor (1.6 kg/ha) + metribuzin (0.75 kg/ha)	DUAL II MAGNUM (915 g/L) + LEXONE DF (75 DF)	1.75 L/ha (0.7 L/acre) + 1 kg/ha (0.4 kg/acre)	· **Established plantings.** · PRE – Apply once per year as a band treatment under the trees before weeds emerge. · Avoid contact with trunk and leaves of trees. · **Do NOT** use on sandy soil with less than 3% organic matter.
metribuzin (0.38–0.75 kg/ha)	LEXONE DF (75 DF)	0.5–1 kg/ha (0.2–0.4 kg/acre)	· New and established plantings. · PPI – Before planting trees. · PRE – Apply once per year as a band treatment under the trees before weeds emerge. · Avoid contact with tree trunks and leaves. · Use high rate on established plantings. · **Do NOT** use on soils that are coarser than sandy loams with less than 3% organic matter.
linuron (4.3 kg/ha)	LOROX DF (50 DF)	8.6 kg/ha (3.44 kg/acre)	· **Established plantings ONLY.** · PRE – Apply as directed spray before weeds are 10 cm high. · Apply in 400–600 L/ha (160–240 L/acre) water with a surfactant. · Avoid contact with fruit, foliage or tree bark with spray or drift. · Use only under trees established at least 10 years.

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
APPLES (cont'd)			
Soil Applied Grass and Broadleaf Herbicides (cont'd)			
simazine (1–2 kg/ha)	PRINCEP NINE-T (90 WG)	1.1–2.2 kg/ha (0.44–0.88 kg/acre)	· **Planting year.** · PRE – Apply post planting, preemergent to weeds, preferably after rain has settled the soil around the trees. · Apply **ONCE** per season. · Avoid contact with trunk and leaves of trees. · **Do NOT** use on sandy soils with less than 2% organic matter.
simazine (2.25–4.5 kg/ha)	PRINCEP NINE-T (90 WG)	2.5–5 kg/ha (1–2 kg/acre)	· Established plantings **ONLY**. · PRE – Apply in 300–1,000 L/ha (120–400 L/acre) water. · Use only under trees planted for 1 year or more. · Use higher rate on perennial weeds such as quackgrass. · May be combined with glyphosate.
	SIMADEX (500 g/L)	4.5–9 L/ha (1.8–3.6 L/acre)	
	SIMAZINE 480 (480 g/L)	4.7–9.4 L/ha (1.88–3.76 L/acre)	
metribuzin (0.41–0.56 kg/ha) + trifluralin (0.6–1.15 kg/ha)	SENCOR 75 DF (75 WG) + TREFLAN EC(480 g/L)	0.55–0.75 kg/ha (0.22–0.3 kg/acre) + 1.2–2.4 L/ha (0.5–0.96 L/acre)	· Make **ONLY** 1 application in the planting year. · PPI – Before planting trees as an orchard floor or planting row treatment. · Apply rates at the upper end of the range to clay soils.
	SENCOR 75 DF (75 WG) + BONANZA 480 (480 g/L)	0.55–0.75 kg/ha (0.22–0.3 kg/acre) + 1.25–2.3 L/ha (0.5–0.92 L/acre)	
terbacil (1 kg/ha)	SINBAR (80 WP)	1.25 kg/ha (0.5 kg/acre)	· **Planting year.** · Make 1 application a year. · PRE – Apply after planting trees, before weeds emerge. · **Do NOT** use on soils with less than 3% organic matter. · Avoid contact with tree trunks and leaves.
	SINBAR (80 WDG)		
terbacil (1.8–3.6 kg/ha)	SINBAR (80 WP)	2.25–4.5 kg/ha (0.9–1.8 kg/acre)	· **Established plantings.** · PRE – Apply in 1,000 L/ha (400 L/acre) water. · Avoid contact with foliage. · Use only under trees established for at least 3 years.
	SINBAR (80 WDG)		
terbacil (0.5 kg/ha) + metribuzin (0.75 kg/ha)	SINBAR (80 WP) + LEXONE DF (75DF)	0.63 kg/ha (0.25 kg/acre) + 1 kg/ha (0.4 kg/acre)	· **Established plantings.** · PRE – Apply as a band under trees before weeds emerge. · Use **ONLY** 1 application per year. · **Do NOT** use on soil coarser than sandy loam with less than 3% organic matter.
	SINBAR (80 WDG) + LEXONE DF (75DF)		
trifluralin (0.6–1.15 kg/ha)	TREFLAN EC (480 g/L)	1.2–2.4 L/ha (0.48–0.96 L/acre)	· **Planting year ONLY.** · PPI – Apply and incorporate before planting trees. · Apply once in the planting year **ONLY**. · Use at least 100 L/ha (40 L/acre) water. · Use higher rates on clay soils.
	BONANZA 480 (480 g/L)	1.25–2.3 L/ha (0.5–0.92 L/acre)	

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
APPLES (cont'd)			
Postemergence Grass Herbicides			
sethoxydim (0.14–0.5 kg/ha) + surfactant/solvent (0.25–2 L/ha)	POAST ULTRA (450 g/L) + MERGE	0.32–1.1 L/ha (0.13–0.44 L/acre) + 0.25–2 L/ha (0.1–0.8 L/acre)	· New and established plantings. · For annual grass, use 0.32 L/ha (0.13 L/ac). Apply at the 1–6 leaf stage. · For volunteer grains, use 0.47 L/ha (0.19 L/acre). · For quackgrass, use 1.1 L/ha (0.44 L/acre). Apply up to the 3 leaf stage. · **Do NOT** apply closer than 30 days to harvest. · **Do NOT** apply if rain is expected within 1 h after application.
fluazifop-p-butyl (0.075–0.25 kg/ha)	VENTURE L (125 g/L)	0.6–2 L/ha (0.24–0.8 L/acre)	· **New and established plantings.** · Apply post to actively growing grasses before tillering. · Apply at 0.6 L/ha (0.24 L/acre) at 2–5 leaf stage of volunteer corn. · Apply at 0.8 L/ha (0.32 L/acre) at 2–5 leaf stage of volunteer wheat and barley. · Apply at 1 L/ha (0.4 L/acre) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails). · Apply at 2 L/ha (0.8 L/acre) at 3–5 leaf stage of quackgrass and wirestem muhly. · Grasses emerging after the treatment will not be controlled. · **Do NOT** apply more than once per year.
Postemergence Broadleaf Herbicides			
2,4-D (0.95 kg/ha)	2,4-D (470 g/L)	2 L/ha (0.8 L/acre)	· **Established plantings ONLY.** · For broadleaf weeds, including dandelion, seedling Canada thistle and sow-thistle. · Apply in early spring after weeds emerge or postharvest to actively growing weeds. · **Do NOT** apply closer than 80 days to harvest.
	2,4-D (564 g/L)	1.68 L/ha (0.67 L/acre)	
	2,4-D (660 g/L)	1.44 L/ha (0.58 L/acre)	
carfentrazone-ethyl (8.8–36 g/ha) + non-ionic surfactant (0.25% v/v)	AIM EC (240 g/L) + AGRAL 90	36.5–150 mL/ha (14.6–60 mL/acre) + 2.5 L/1,000 L	· **New and established plantings.** · Apply post with a hooded sprayer between the rows. · Apply to basal shoots (suckers) before they have hardened bark. · Use the higher rate of 150 mL/ha (60 mL/acre) for control of suckers. · Apply to actively growing weeds up to 10 cm tall. · Apply in of 200 L/ha (80 L/acre) water. · **Do NOT** apply closer than 30 days to harvest. · **Do NOT** exceed two applications a year. · Severe injury may result if the spray is allowed to come in contact with the green bark, leaves, bloom or fruit.
	AIM EC (240 g/L) + AG-SURF	36.5–150 mL/ha (14.6–60 mL/acre) + 2.5 L/1,000 L	
carfentrazone-ethyl (8.8–36 g/ha) + surfactant/solvent (0.1% v/v)	AIM EC (240 g/L) + MERGE	36.5–150 mL/ha (14.6–60 mL/acre) + 1 L/1,000 L	
bentazon (0.84–1.08 kg/ha) + oil concentrate (1–2 L/ha)	BASAGRAN (480 g/L) + ASSIST	1.75–2.25 L/ha (0.7–0.9 L/acre) + 1–2 L/ha (0.4–0.8 L/acre)	· **New plantings.** · Directed spray only. **Do NOT** overspray. · Apply in 100–400 L/ha (40–160 L/acre) water with at least 275 kPa pressure. · Avoid tree leaves. · Use lower rate of assist under hot, humid conditions. · During the planting year, make a maximum of two applications per season, 10 days apart and at the low rate only.

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS • For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
APPLES (cont'd)			
Postemergence Broadleaf Herbicides (cont'd)			
clopyralid (0.202 kg/ha)	LONTREL 360 (360 g/L)	0.56 L/ha (0.22 L/acre)	• **New and established plantings.** • For control of vetch at early flowering stage. • Apply in the spring as a spot treatment. • Avoid contact with tree limbs. • **Do NOT** apply when usable fruit is on the orchard floor. • **Do NOT** apply closer than 30 days to harvest.
halosulfuron (25–102 g/ha) + non-ionic surfactant (0.25% v/v)	SANDEA (72.6 WG) + non-ionic surfactant	35–140 g/ha (14–56 g/acre) + 2.5 L/1,000 L	• **New, 1 year or more and established plantings ONLY** • Apply as a single or sequential application of 35–70 g/ha (14–28 g/acre), allow a minimum of 21 days between applications • Use a higher rate of 52.5–140 g/ha (21–56 g/acre) for nutsedge control when fully emerged. If applying twice, apply first application at 3–5 leaf stage. • Do not apply more than 140 g/ha (56 g/acre) per season. • Avoid spray contact with foliage and fruit. • Use a minimum water volume of 140 L/ha (56 L/ha). • **Do NOT** spray over top of plastic mulch. • **Do NOT** harvest within 14 days after application.
Non-Selective Herbicides and Tank Mix Options			
Indaziflam (0.0758 kg/ha) + paraquat (1.1 kg/ha)	ALION (200 g/L) + GRAMOXONE (200 g/L)	0.375 L/ha (0.152 L/acre) + 5.5 L/ha (2.2 L/acre)	• Apply **ONLY** to crops that have been established for at least three full growing seasons • Do not apply prior to any type of soil disturbance • Apply only once per growing season. • Excessive crop or weed debris present on soil surface at time of application may prevent uniform product distribution reaching the soil and result in reduced weed control
Indaziflam (0.075 kg/ha) + metribuzin (0.72 kg/ha)	ALION (200 g/L) + SENCOR 480F (480 g/L)	0.375 L/ha (0.152 L/acre) + 1.5 L/ha (0.606 L/acre)	• **Established plantings only** • Pre-emergent weeds control plus residual control of annual broadleaf weeds • Apply only once per season • Apply only to crops that have been established for at least 3 years
	ALION (200 g/L) + SENCOR 75 DF (75 WG)	0.375 L/ha (0.152 L/acre) + 1.0 kg/ha (0.404 kg/acre)	
glyphosate (0.81–4.32 kg/ha)	glyphosate (360 g/L)*	2.25–12 L/ha (0.9–4.8 L/acre)	• **Established plantings ONLY.** • For actively growing weeds. • Apply in 200–300 L/ha (80–120 L/acre) water as a directed spray. • Remove all suckers from base of trunks two weeks before application. • **Do NOT** apply to trees with green bark in the area of application. • **Do NOT** mow or till weeds for at least 5–7 days after application. Wait longer if cool. • Only weeds emerged at application time will be controlled. Additional weed control programs will be necessary to control weeds germinating later. • Repeat application to regrowth may be necessary for complete control. • **Do NOT** apply closer than 30 days to harvest. • For specific information on product rates and notes for annual and perennial weed control refer to Table 6–3. Specific Notes on Weeds Controlled and Product Rates Associated with Various Glyphosate Concentrations, page 94. * See Table 4–1. Herbicides Used In Ontario, page 30, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.
	glyphosate (480 g/L)*	1.69–9 L/ha (0.68–3.6 L/acre)	
	glyphosate (500 g/L)*	1.62–8.64 L/ha (0.65–3.5 L/acre)	
	glyphosate (540 g/L)*	1.5–8 L/ha (0.6–3.2 L/acre)	

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
APPLES (cont'd)			
Non-Selective Herbicides and Tank Mix Options (cont'd)			
glyphosate (0.36 kg/2 L)	glyphosate (360 g/L)*	1 L/2 L water	· **Established plantings ONLY.** · Apply with a rope wick or other similar device when weeds are at the optimum stage. See label for optimum stage. · Avoid contact with the leaves, trunks and suckers. · **Do NOT** apply when weeds are wet. · See Wick Wiper and Roller Application, page 100. · **Do NOT** apply closer than 30 days to harvest. * See Table 4–1. Herbicides Used In Ontario, page 30, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.
	glyphosate (480 g/L)*	0.75 L/2 L water	
	glyphosate (500 g/L)*	0.72 L/2 L water	
	glyphosate (540 g/L)*	0.67 L/2 L water	
glyphosate (0.36–0.72 kg/100 L)	glyphosate (360 g/L)*	1–2 L/100 L water	· **Established plantings ONLY.** · Use hand held sprayers as a spot treatment if wiper equipment is not available. · Avoid contact with leaves, trunks and suckers. · **Do NOT** apply closer than 30 days before harvest. * See Table 4–1. Herbicides Used In Ontario, page 30, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.
	glyphosate (480 g/L)*	0.75–1.5 L/100 L water	
	glyphosate (500 g/L)*	0.72–1.44 L/100 L water	
	glyphosate (540 g/L)*	0.67–1.34 L/100 L water	
glyphosate (0.81–4.32 kg/ha) + indaziflam (0.075 kg/ha)	glyphosate (360 g/L)* + ALION 200 SC (200 g/L)	2.25–12 L/ha (0.9–4.8 L/acre) + 0.375 L/ha (0.152 L/acre)	· **Established plantings ONLY.** · **Do NOT** apply to trees with green bark in the area of application. · **Do NOT** apply closer than 30 days to harvest. · Apply **ONLY** once per growing season. · Apply **ONLY** to crops that have been established for at least three full growing seasons. · For specific information on product rates and notes for annual and perennial weed control refer to Table 6–3. Specific Notes on Weeds Controlled and Product Rates Associated with Various Glyphosate Concentrations, page 94. · Consult the label of the tank mix partner(s) for further instructions regarding product rates, directions for use, restrictions, personal protective equipment and precautions. * See Table 4–1. Herbicides Used In Ontario, page 30, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.
	glyphosate (480 g/L)* + ALION 200 SC (200 g/L)	1.69–9 L/ha (0.68–3.6 L/acre) + 0.375 L/ha (0.152 L/acre	
	glyphosate (500 g/L)* + ALION 200 SC (200 g/L)	1.62–8.64 L/ha (0.65–3.5 L/acre) + 0.375 L/ha (0.152 L/acre	
	glyphosate (540 g/L)* + ALION 200 SC (200 g/L)	1.5–8 L/ha (0.6–3.2 L/acre) + 0.375 L/ha (0.152 L/acre	
paraquat (1.1 kg/ha)	GRAMOXONE (200 g/L)	5.5 L/ha (2.2 L/acre)	· **Established plantings ONLY.** · Apply in 1,100 L/ha (440 L/acre) water. · For spot spraying, apply 55 mL in 10 L of water sprayed to wet weed foliage. · Use on trees established 1 year or more. · Avoid contact with green bark, leaves or fruit. · May be used in mixtures with SINBAR, DEVRINOL or SIMAZINE.
paraquat (1.1 kg/ha) + napropamide (4.5 kg/ha)	GRAMOXONE (200 g/L) + DEVRINOL DF (50 DF)	5.5 L/ha (2.2 L/acre) + 9 kg/ha (3.6 kg/acre)	· **Established plantings ONLY.** · Add DEVRINOL to tank first then agitate and add GRAMOXONE. · Apply in 1,100 L/ha (440 L/acre) water. · Use on trees established 1 year or more. · Avoid contact with green bark, leaves or fruit.
	GRAMOXONE (200 g/L) + DEVRINOL DF-XT (50 DF-XT)		

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
APPLES (cont'd)			
Non-Selective Herbicides and Tank Mix Options (cont'd)			
paraquat (1.1 kg/ha) + simazine (2.25–4.5 kg/ha)	GRAMOXONE (200 g/L) + PRINCEP NINE-T (90 WG)	5.5 L/ha (2.2 L/acre) + 2.5–5 kg/ha (1–2 kg/acre)	· **Established plantings ONLY.** · To control emerged weeds and provide residual control of germinating weeds. · Use on trees established 1 year or more. · Avoid contact with green bark, leaves or fruit. · See precautions on GRAMOXONE, on page 357 and PRINCEP, page 354
glufosinate ammonium (0.405–0.75 kg/ha)	IGNITE (150 g/L)	2.7–5 L/ha (1.08–2 L/acre)	· **Established plantings ONLY.** · Apply as a directed spray before weeds are 30 cm high. · Use 110–330 L/ha (44–132 L/acre) water. · Where weed growth is heavy, use the higher rate and larger water volume. · **Do NOT** apply closer than 40 days to harvest. · For trees established at least 1 year. · **Do NOT** make more than two applications a year. · **Do NOT** apply more than 6.7 L/ha (2.7 L/acre) in 1 year.
glufosinate ammonium (0.405–0.75 kg/ha) + indaziflam (0.075 kg/ha)	IGNITE (150 g/L) + ALION 200 SC (200 g/L)	2.7–5 L/ha (1.08–2 L/acre) + 0.375 L/ha (0.152 L/acre)	· **Established plantings ONLY.** · Apply as a directed spray before weeds are 30 cm high, when the ground is not frozen or snow covered. · Use 110–330 L/ha (44–132 L/acre) water. Where weed growth is heavy, use the higher rate and larger water volume. · **Do NOT** apply closer than 40 days to harvest. · Apply **ONLY** to crops that have been established for at least three full growing seasons. · Apply **ONLY** once per growing season. · Consult the label of the tank mix partner(s) for further instructions regarding product rates, directions for use, restrictions, personal protective equipment and precautions.
glufosinate ammonium (0.405–0.75 kg/ha) + simazine (2.25–4.5 kg/ha)	IGNITE (150 g/L) + PRINCEP NINE-T (90 WG)	2.7–5 L/ha (1.08–2 L/acre) + 2.5–5 kg/ha (1–2 kg/acre)	· **Established plantings ONLY.** · To control emerged weeds plus residual control of annual grasses and broadleaf weeds. · Use as a directed spray around the bases of trees established once a year. · **Do NOT** apply closer than 40 days to harvest.
	IGNITE (150 g/L) + SIMADEX (500 g/L)	2.7–5 L/ha (1.08–2 L/acre) + 4.5–9 L/ha (1.8–3.6 L/acre)	
simazine (2.25–4.5 kg/ha) + glyphosate (0.8–4.27 kg/ha)	PRINCEP NINE-T (90 WG) + glyphosate (360 g/L)*	2.5–5 kg/ha (1–2 kg/acre) + 2.25–12 L/ha (0.9–4.8 L/acre)	· **Established plantings ONLY.** · To control actively growing weeds, with residual control of germinating weeds. · Apply in 200–300 L/ha (80–120 L/acre) water as a directed spray. · Remove all suckers from base of trunks two weeks before application. · **Do NOT** apply to trees with green bark in the area of application. * See Table 4-1. Herbicides Used In Ontario, page 30, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.
	PRINCEP NINE-T (90 WG) + glyphosate (480 g/L)*	2.5–5 kg/ha (1–2 kg/acre) + 1.67–8.9 L/ha (0.67–3.56 L/acre)	
	PRINCEP NINE-T (90 WG) + glyphosate (500 g/L)*	2.5–5 kg/ha (1–2 kg/acre) + 1.6–8.54 L/ha (0.64–3.41 L/acre)	
	PRINCEP NINE-T (90 WG) + glyphosate (540 g/L)*	2.5–5 kg/ha (1–2 kg/acre) + 1.48–7.9 L/ha (0.59–3.16 L/acre)	

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
APRICOTS			
Site Preparation Before Planting – See Chapter 6, Preplant & Postharvest Weed Control, page 91.			
Rates per hectare or per acre refer to area actually treated with herbicide. Unless specified, apply all treatments in 150–300 L/ha (60–120 L/acre) water.			
CAUTION – SIMAZINE, DEVRINOL and SINBAR residues, high enough to harm many crops, may persist for several years after removal of orchard.			
Soil Applied Broadleaf Herbicide			
carfentrazone-ethyl (8.8–36 g/ha) + non-ionic surfactant (0.25% v/v)	AIM EC (240 g/L) + AGRAL 90	36.5–150 mL/ha (14.8–60 mL/acre) + 2.5 L/1,000 L	· **New and established plantings.** · Apply POST with a hooded sprayer between the rows. · Apply to actively growing weeds up to 10 cm tall. · Apply to basal shoots (suckers) before they have a hardened bark. · Use a higher rate of 150 mL/ha (60 mL/acre) for control of suckers. · Apply 200 L/ha (80 L/acre) water. · **Do NOT** apply closer than 30 days to harvest. · **Do NOT** exceed more than two applications per year. · Severe injury may result if the spray is allowed to come in contact with the green bark, leaves, bloom or fruit.
	AIM EC (240 g/L) + AG-SURF		
carfentrazone-ethyl (8.8–36 g/ha) + surfactant/solvent (0.1% v/v)	AIM EC (240 g/L) + MERGE	36.5–150 mL/ha (14.8–60 mL/acre) + 1 L/1,000 L	
Soil Applied Grass and Broadleaf Herbicides			
indaziflam (0.075 kg/ha)	ALION 200 SC (200 g/L)	0.375 L/ha (0.152 L/acre)	· **Established plantings ONLY.** · PRE to weeds. Apply to soil before weeds germinate. If weeds have emerged, this product may be tank-mixed with a burndown herbicide (consult label for further instructions). · May be applied at anytime throughout the growing season when the ground is not frozen or snow covered. · Excessive crop or weed debris present on the soil surface at time of application may prevent uniform product distribution reaching the soil and result in reduced weed control. · Apply **ONLY** once per growing season. · Apply **ONLY** to crops that have been established for at least three full growing seasons.
flumioxazin (0.14–0.21 kg/ha)	CHATEAU WDG (51.1%)	0.28–0.42 kg/ha (0.11–0.17 kg/acre)	· **Established plantings ONLY.** · Maximum 2 applications per growing season at least 30 days apart. · **Do NOT** apply within 100 m of non-dormant pears. · Apply using ground application only. · Apply the lower rate to coarse textured soils with less than 5% organic matter and apply the higher rate to medium textures soils with less than 5% organic matter. · **Do NOT** apply to trees established less than 2 years. · **Do NOT** apply during the period after flowering through leaf drop unless using hooded or shielded equipment. · After use, tanks and nozzles must be cleaned with a 3% ammonia solution. Please review label for more detailed instructions. · **Do NOT** harvest within 60 days of application.
s-metolachlor/ benoxacor (1.6 kg/ha)	DUAL II MAGNUM (915 g/L)	1.75 L/ha (0.7 L/acre)	· **New and established plantings.** · PRE – Apply once per year as a band treatment under the trees before weeds emerge. · Avoid contact with trunk and leaves of trees. · **Do NOT** use on sandy soil with less than 2% organic matter.

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
APRICOTS (cont'd)			
Soil Applied Grass and Broadleaf Herbicides (cont'd)			
napropamide (3.5 kg/ha) + simazine (2 kg/ha)	DEVRINOL DF (50 DF) + PRINCEP NINE-T (90 WG) DEVRINOL DF-XT (50 DF-XT) + PRINCEP NINE-T (90 WG)	7 kg/ha (2.8 kg/acre) + 2.25 kg/ha (0.9 kg/acre)	· **Planting year ONLY.** · PRE – Apply in the fall through early spring before weeds emerge. · Incorporation by rainfall or irrigation is essential. · **Do NOT** apply on frozen ground. · Make **ONLY** 1 application in the year of planting.
napropamide (4.5 kg/ha) + terbacil (0.48 kg/ha)	DEVRINOL DF (50 DF) + SINBAR (80 WP) DEVRINOL DF (50 DF) + SINBAR (80 WDG) DEVRINOL DF-XT (50 DF-XT) + SINBAR (80 WP) DEVRINOL DF-XT (50 DF-XT) + SINBAR (80 WDG)	9 kg/ha (3.6 kg/acre) + 0.6 kg/ha (0.24 kg/acre)	· **Planting year ONLY.** · PRE – Apply in the fall through early spring before weeds emerge. · Incorporation by rainfall or irrigation is essential. · **Do NOT** apply on frozen ground. · Make only 1 application in the year of planting.
s-metolachlor/ benoxacor (1.6 kg/ha) + metribuzin (0.75 kg/ha)	DUAL II MAGNUM (915 g/L) + LEXONE DF (75 DF)	1.75 L/ha (0.7 L/acre) + 1 kg/ha (0.4 kg/acre)	· **Established plantings ONLY.** · PRE – Apply once per year as a band treatment under the trees before weeds emerge. · Avoid contact with trunk and leaves of trees. · **Do NOT** use on sandy soil with less than 3% organic matter.
s-metolachlor/ benoxacor (1.14–1.6 kg/ha) + simazine (1–2.25 kg/ha)	DUAL II MAGNUM (915 g/L) + PRINCEP NINE-T (90 WG)	1.25–1.75 L/ha (0.5–0.7 L/acre) + 1.1–2.5 kg/ha (0.44–1 kg/acre)	· **New and established plantings.** · PRE – Apply after planting, before weeds emerge, preferably after rain has settled the soil around the trees. · Apply once in the year of planting. · **Do NOT** use on sandy soils with less than 2% organic matter. · Avoid contact with tree trunks and leaves. · Apply high rate on established plantings.
metribuzin (0.38–0.75 kg/ha)	LEXONE DF (75 DF)	0.5–1 kg/ha (0.2–0.4 kg/acre)	· **New and established plantings.** · PPI – Apply before planting trees in the year of planting. · PRE – Apply once per year as a band treatment under the trees before weeds emerge. · Avoid contact with tree trunks and leaves.
simazine (1–2 kg/ha)	PRINCEP NINE-T (90 WG)	1.1–2.2 kg/ha (0.44–0.88 kg/acre)	· **Planting year ONLY.** · PRE – Apply after planting, before weeds emerge, preferably after rain has settled the soil around the trees. · Apply **ONLY** once per season. · Avoid contact with trunk and leaves of trees. · **Do NOT** use on sandy soils with less than 2% organic matter.
metribuzin (0.41–0.56 kg/ha) + trifluralin (0.6–1.15 kg/ha)	SENCOR 75 DF (75 WG) + TREFLAN EC (480 g/L) SENCOR 75 DF (75 WG) + BONANZA 480 (480 g/L)	0.55–0.75 kg/ha (0.22–0.3 kg/acre) + 1.2–2.4 L/ha (0.5–0.96 L/acre) 0.55–0.75 kg/ha (0.22–0.3 kg/acre) + 1.25–2.3 L/ha (0.5–0.92 L/acre)	· **Planting year ONLY.** · PPI– Apply and incorporate before planting trees. · Apply as an orchard floor or planting row treatment. · Apply once in the year of planting only. · Apply higher rates to clay soils.

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
APRICOTS (cont'd)			
Soil Applied Grass and Broadleaf Herbicides (cont'd)			
terbacil (0.5 kg/ha) + metribuzin (0.75 kg/ha)	SINBAR (80 WP) + LEXONE DF (75 DF)	0.63 kg/ha (0.25 kg/acre) + 1 kg/ha (0.4 kg/acre)	· **Established plantings ONLY.** · PRE – Apply as a band under trees before weeds emerge. · Use **ONLY** 1 application per year. · **Do NOT** use on soil coarser than sandy loam with less than 3% organic matter.
	SINBAR (80 WDG) + LEXONE DF (75 DF)		
trifluralin (0.6–1.15 kg/ha)	TREFLAN EC (480 g/L)	1.25–2.4 L/ha (0.5–0.96 L/acre)	· **Planting year ONLY.** · PPI – Apply and incorporate before planting trees. · Use at least 100 L/ha (40 L/acre) water. · Apply **ONLY** once in the planting year. · Apply higher rates on clay soils.
	BONANZA 480 (480 g/L)	1.25–2.3 L/ha (0.5–0.92 L/acre)	
Postemergence Grass Herbicides			
sethoxydim (0.14–0.5 kg/ha) + surfactant/solvent (0.25–2 L/ha)	POAST ULTRA (450 g/L) + MERGE	0.32–1.1 L/ha (0.13–0.44 L/acre) + 0.25–2 L/ha (0.1–0.8 L/acre)	· **New and established plantings.** · For annual grass, use 0.32 L/ha (0.13 L/acre). Apply at the 1–6 leaf stage. · For volunteer grains, use 0.47 L/ha (0.19 L/acre). · For quackgrass, use 1.1 L/ha (0.44 L/acre). Apply up to the 3 leaf stage. · **Do NOT** apply closer than 30 days to harvest. · **Do NOT** apply if rain is expected within 1 h after application.
fluazifop-p-butyl (0.075–0.25 kg/ha)	VENTURE L (125 g/L)	0.6–2 L /ha (0.24–0.8 L/acre)	· **Established plantings ONLY.** · Apply post to actively growing grasses before tillering. · Apply at 0.6 L/ha (0.24 L/acre) at 2–5 leaf stage of volunteer corn. · Apply at 0.8 L/ha (0.32 L/acre) at 2–5 leaf stage of volunteer wheat and barley. · Apply at 1 L/ha (0.4 L/acre) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails). · Apply at 2 L/ha (0.8 L/acre) at 3–5 leaf stage of quackgrass and wirestem muhly. · Grasses emerging after the treatment will not be controlled. · **ONLY** apply once per year.
Postemergence Broadleaf Herbicides			
2,4-D (0.95 kg/ha)	2,4-D (470 g/L)	2 L/ha (0.8 L/acre)	· **Established plantings ONLY.** · For broadleaf weeds, including dandelion, seedling Canada thistle and sow-thistle. · Apply in early spring after weeds emerge or postharvest to actively growing weeds. · **Do NOT** apply closer than 80 days to harvest.
	2,4-D (564 g/L)	1.68 L/ha (0.67 L/acre)	
	2,4-D (660 g/L)	1.44 L/ha (0.58 L/acre)	

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
APRICOTS (cont'd)			
Postemergence Broadleaf Herbicides (cont'd)			
carfentrazone-ethyl (8.8–28.1 g/ha) + non-ionic surfactant (0.25% v/v)	AIM EC (240 g/L) + AGRAL 90	36.5–117 mL/ha (14.8–47 mL/acre) + 2.5 L/1,000 L	· **New and established plantings.** · Apply post with a hooded sprayer between the rows. · Apply to actively growing weeds up to 10 cm tall. · Apply in a minimum of 100 L/ha (40 L/acre) water. · **Do NOT** apply closer than 3 days to harvest. · Apply **ONLY** once per growing season. · Severe crop injury may result if the spray is allowed to come in contact with the green bark, leaves, bloom or fruit.
	AIM EC (240 g/L) + AG-SURF		
carfentrazone-ethyl (8.8–28.1 g/ha) + surfactant/solvent (0.1% v/v)	AIM EC (240 g/L) + MERGE	36.5–117 mL/ha (14.8–47 mL/acre) + 1 L/1,000 L	
bentazon (0.84–1.08 kg/ha) + surfactant/solvent (1–2 L/ha)	BASAGRAN (480 g/L) + MERGE	1.75–2.25 L/ha (0.7–0.9 L/acre) + 1–2 L/ha (0.4–0.8 L/acre)	· **Planting year ONLY.** · Directed spray only. **Do NOT** overspray. · Apply in 100–400 L/ha (40–160 L/acre) water with at least 275 kPa pressure. · Use lower rate of MERGE under hot, humid conditions. · Make **ONLY** 2 applications, 10 days apart at 1.75 L/ha (0.7 L/acre) in the planting year.
clopyralid (0.15–0.30 kg/ha)	LONTREL 360 (360 g/L)	0.42–0.83 L/ha (0.17 – 0.34 L/acre)	· **New and established plantings** · For control of broadleaf weeds including vetch at the early flowering stage. · For best results apply in the spring as a spot treatment when apricots are flowering. · Apply 42– 83 mL per 1000 m^2 in 300 L of water when using a hand gun or back pack sprayer. · Avoid contact with tree limbs. · **Do NOT** apply closer than 30 days to harvest.
Non-Selective Herbicides and Tank Mix Options			
Indaziflam (0.0758 kg/ha) + paraquat (1.1 kg/ha)	ALION (200 g/L) + GRAMOXONE (200 g/L)	0.375 L/ha (0.152 L/acre) + 5.5 L/ha (2.2 L/acre)	· Apply **ONLY** to crops that have been established for at least three full growing seasons · Do not apply prior to any type of soil disturbance · Apply only once per growing season. · Excessive crop or weed debris present on soil surface at time of application may prevent uniform product distribution reaching the soil and result in reduced weed control
Indaziflam (0.075 kg/ha) + metribuzin (0.72 kg/ha)	ALION (200 g/L) + SENCOR 480F (480 g/L)	0.375 L/ha (0.152 L/acre) + 1.5 L/ha (0.606 L/acre)	· Established plantings only · Pre-emergent weeds control plus residual control of annual broadleaf weeds · Apply only once per season · Apply only to crops that have been established for at least 3 years
	ALION (200 g/L) + SENCOR 75 DF (75 WG)	0.375 L/ha (0.152 L/acre) + 1.0 kg/ha (0.404 kg/acre)	

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
APRICOTS (cont'd)			
Non-Selective Herbicides and Tank Mix Options (cont'd)			
glyphosate (0.81–4.32 kg/ha)	glyphosate (360 g/L)*	2.25–12 L/ha (0.9–4.8 L/acre)	· **Established plantings ONLY.** · For actively growing weeds. · Apply in 200–300 L/ha (80–120 L/acre) water as a directed spray. · Remove all suckers from base of trunks two weeks before application. · **Do NOT** apply to trees with green bark in the area of application. · **Do NOT** mow or till weeds for at least 5–7 days after application. Wait longer if cool. · **ONLY** weeds emerged at application time will be controlled. Additional weed control programs will be necessary to control weeds germinating later. · Repeat application to regrowth may be necessary for complete control. · **Do NOT** apply closer than 30 days to harvest. · For specific information on product rates and notes for annual and perennial weed control refer to Table 6–3. Specific Notes on Weeds Controlled and Product Rates Associated with Various Glyphosate Concentrations, page 94. * See Table 4–1. Herbicides Used In Ontario, page 30, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.
	glyphosate (480 g/L)*	1.69–9 L/ha (0.68–3.6 L/acre)	
	glyphosate (500 g/L)*	1.62–8.64 L/ha (0.65–3.5 L/acre)	
	glyphosate (540 g/L)*	1.5–8 L/ha (0.6–3.2 L/acre)	
glyphosate (0.36 kg/2 L)	glyphosate (360 g/L)*	1 L/2 L water	· **Established plantings ONLY.** · Apply with a rope wick or other similar device when weeds are at the optimum stage. · Avoid contact with the leaves, trunks and suckers. · **Do NOT** apply when weeds are wet. · See Wick Wiper and Roller Application, page 100. · **Do NOT** apply closer than 30 days to harvest. * See Table 4–1. Herbicides Used In Ontario, page 30, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.
	glyphosate (480 g/L)*	0.75 L/2 L water	
	glyphosate (500 g/L)*	0.72 L/2 L water	
	glyphosate (540 g/L)*	0.67 L/2 L water	
glyphosate (0.36–0.72 kg/100 L)	glyphosate (360 g/L)*	1–2 L/100 L water	· **Established plantings ONLY.** · Use hand held sprayers as a spot treatment if wiper equipment is not available. · Avoid contact with leaves, trunks and suckers. · **Do NOT** apply closer than 30 days before harvest. * See Table 4–1. Herbicides Used In Ontario, page 30, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.
	glyphosate (480 g/L)*	0.75–1.5 L/100 L water	
	glyphosate (500 g/L)*	0.72–1.44 L/100 L water	
	glyphosate (540 g/L)*	0.67–1.34 L/100 L water	

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
APRICOTS (cont'd)			
Non-Selective Herbicides and Tank Mix Options (cont'd)			
glyphosate (0.81–4.32 kg/ha) + indaziflam (0.075 kg/ha)	glyphosate (360 g/L)* + ALION 200 SC (200 g/L)	2.25–12 L/ha (0.9–4.8 L/acre) + 0.375 L/ha (0.152 L/acre)	· **Established plantings ONLY.** · **Do NOT** apply to trees with green bark in the area of application. · **Do NOT** apply closer than 30 days to harvest. · Apply **ONLY** once per growing season. · Apply **ONLY** to crops that have been established for at least three full growing seasons. · For specific information on product rates and notes for annual and perennial weed control refer to Table 6–3. Specific Notes on Weeds Controlled and Product Rates Associated with Various Glyphosate Concentrations, page 94. · Consult the label of the tank mix partner(s) for further instructions regarding product rates, directions for use, restrictions, personal protective equipment and precautions. * See Table 4–1. Herbicides Used In Ontario, page 30, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.
	glyphosate (480 g/L)* + ALION 200 SC (200 g/L)	1.69–9 L/ha (0.68–3.6 L/acre) + 0.375 L/ha (0.152 L/acre)	
	glyphosate (500 g/L)* + ALION 200 SC (200 g/L)	1.62–8.64 L/ha (0.65–3.5 L/acre) + 0.375 L/ha (0.152 L/acre)	
	glyphosate (540 g/L)* + ALION 200 SC (200 g/L)	1.5–8 L/ha (0.6–3.2 L/acre) + 0.375 L/ha (0.152 L/acre)	
paraquat (1.1 kg/ha)	GRAMOXONE (200 g/L)	5.5 L/ha (2.2 L/acre)	· **Established plantings ONLY.** · Apply in 1,100 L/ha (440 L/acre) water. · For spot spraying, apply 55 mL in 10 L of water sprayed to wet weed foliage. · Use in orchards established 1 year or more. · Avoid contact with green bark, leaves or fruit.
CHERRIES AND PLUMS			
Site Preparation Before Planting – See Chapter 6, Preplant & Postharvest Weed Control, page 91.			
Rates per hectare or per acre refer to area actually treated with herbicide. Unless specified, apply all treatments in 150–300 L/ha (60–120 L/acre) water.			
CAUTION – Simazine, DEVRINOL and SINBAR residues, high enough to harm many crops, may persist for several years after removal of orchard.			
Soil Applied Grass and Broadleaf Herbicides			
indaziflam (0.075 kg/ha)	ALION 200 SC (200 g/L)	0.375 L/ha (0.152 L/acre)	· **Established plantings ONLY.** · PRE to weeds. Apply to soil before weeds germinate. If weeds have emerged, this product may be tank-mixed with a burndown herbicide (consult label for further instructions). · May be applied at anytime throughout the growing season when the ground is not frozen or snow covered. · Excessive crop or weed debris present on the soil surface at time of application may prevent uniform product distribution reaching the soil and result in reduced weed control. · Apply **ONLY** once per growing season. · Apply **ONLY** to crops that have been established for at least three full growing seasons.
dichlobenil (4.4–7 kg/ha)	CASORON G-4 (4 GR)	110–175 kg/ha (44–70 kg/acre)	· **Established plantings.** · PRE – Apply to cool, moist soil in spring before weeds emerge or after cultivation. · **Do NOT** apply if air temperatures are above 10–15°C to avoid injury from volatilization. · **Do NOT** apply until 4 weeks after transplanting. · **Do NOT** use on light sandy soils. · 70 g applied to an area 2 × 2 m is equivalent to 175 kg/ha (70 kg/acre).

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
CHERRIES AND PLUMS (cont'd)			
Soil Applied Grass and Broadleaf Herbicides (cont'd)			
flumioxazin (0.14–0.21 kg/ha)	CHATEAU WDG (51.1%)	0.28–0.42 kg/ha (0.11–0.17 kg/acre)	· **Established plantings ONLY.** · Maximum 2 applications per growing season at least 30 days apart. · Apply the lower rate to coarse textured soils with less than 5% organic matter and apply the higher rate to medium textured soils with less than 5% organic matter. · **Do NOT** apply within 100 m of non-dormant pears. · Apply using ground application **ONLY.** · **Do NOT** apply to trees established less than 2 years. · **Do NOT** apply during the period after flowering through leaf drop unless using hooded or shielded equipment. · After use, tanks and nozzles must be cleaned with a 3% ammonia solution. Please review label for more detailed instructions. · **Do NOT** harvest within 60 days of application.
napropamide (3.5 kg/ha) + simazine (2 kg/ha)	DEVRINOL DF (50 DF) + PRINCEP NINE-T (90 WG) DEVRINOL DF-XT (50 DF-XT) + PRINCEP NINE-T (90 WG)	7 kg/ha (2.8 kg/acre) + 2.25 kg/ha (0.9 kg/acre)	· **Planting year ONLY.** · PRE – Apply in the fall through early spring before weeds emerge. · Incorporation by rainfall or irrigation is essential. · **Do NOT** apply on frozen ground. · Make **ONLY** 1 application in the planting year.
napropamide (4.5 kg/ha) + terbacil (0.48 kg/ha)	DEVRINOL DF (50 DF) + SINBAR (80 WP) DEVRINOL DF (50 DF) + SINBAR (80 WDG) DEVRINOL DF-XT (50 DF-XT) + SINBAR (80 WP) DEVRINOL DF-XT (50 DF-XT) + SINBAR (80 WDG)	9 kg/ha (3.6 kg/acre) + 0.6 kg/ha (0.24 kg/acre)	· **Planting year ONLY.** · PRE – Apply in the fall through early spring before weeds emerge. · Incorporation by rainfall or irrigation is essential. · **Do NOT** apply on frozen ground. · Make **ONLY** 1 application in the planting year.
s-metolachlor/ benoxacor (1.6 kg/ha)	DUAL II MAGNUM (915 g/L)	1.75 L/ha (0.7 L/acre)	· **New and established plantings.** · PRE – Apply once per year as a band treatment under the trees before weeds emerge. · Avoid contact with trunk and leaves of trees. · **Do NOT** use on sandy soil with less than 2% organic matter.
s-metolachlor/ benoxacor (1.6 kg/ha) + metribuzin (0.75 kg/ha)	DUAL II MAGNUM (915 g/L) + LEXONE DF (75 DF)	1.75 L/ha (0.7 L/acre) + 1 kg/ha (0.4 kg/acre)	· **Established plantings ONLY.** · PRE – Apply once per year as a band treatment under the trees before weeds emerge. · Avoid contact with trunk and leaves of trees. · **Do NOT** use on sandy soil with less than 3% organic matter.
s-metolachlor/ benoxacor (1.14–1.6 kg/ha) + simazine (1–2.25 kg/ha)	DUAL II MAGNUM (915 g/L) + PRINCEP NINE-T (90 WG)	1.25–1.75 L/ha (0.5–0.7 L/acre) + 1.1–2.5 kg/ha (0.44–1 kg/acre)	· **New plantings.** · PRE – Apply after planting, before weeds emerge, preferably after rain has settled the soil around the trees. · Apply once in the year of planting. · **Do NOT** use on sandy soils with less than 2% organic matter. · Avoid contact with tree trunks and leaves. · Late season crabgrass and fall panicum may escape this treatment.

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
CHERRIES AND PLUMS (cont'd)			
Soil Applied Grass and Broadleaf Herbicides (cont'd)			
metribuzin (0.38–0.75 kg/ha)	LEXONE DF (75DF)	0.5–1 kg/ha (0.2–0.4 kg/acre)	· **New and established plantings.** · PPI – Before planting trees. · PRE – Apply once per year as a band treatment under the trees before weeds emerge. · Avoid contact with tree trunks and leaves. · Use high rate on established plantings. · **Do NOT** use on soils that are coarser than sandy loams with less than 3% organic matter.
linuron (4.3 kg/ha)	LOROX DF (50 DF)	8.6 kg/ha (3.44 kg/acre)	· **Established plantings ONLY.** · Use **ONLY** under trees established for 10 years. · PRE – Apply as a directed spray before weeds are 10 cm high. · Apply in 400–600 L/ha (160–240 L/acre) water with a surfactant. · Keep spray off fruit, leaves and green bark of trees.
metribuzin (0.41–0.56 kg/ha) + trifluralin (0.6–1.15 kg/ha)	SENCOR 75 DF (75 WG) + TREFLAN EC (480 g/L)	0.55–0.75 kg/ha (0.22–0.3 kg/acre) + 1.2–2.4 L/ha (0.48–0.96 L/acre)	· **Planting year ONLY.** · Apply **ONLY** once in the year of planting. · PPI – Apply and incorporate before planting trees. · Apply higher rates to clay soils.
	SENCOR 75 DF (75 WG) + BONANZA 480 (480 g/L)	0.55–0.75 kg/ha (0.22–0.3 kg/acre) + 1.25–2.3 L/ha (0.5–0.92 L/acre)	
terbacil (1 kg/ha)	SINBAR (80 WP)	1.25 kg/ha (0.5 kg/acre)	· **Planting year.** · PRE – Apply after planting trees, before weeds emerge. · **Do NOT** use on soils with less than 3% organic matter. · Avoid contact with tree trunks and leaves.
	SINBAR (80 WDG)		
terbacil (0.5 kg/ha) + metribuzin (0.75 kg/ha)	SINBAR (80 WP) + LEXONE DF (75DF)	0.63 kg/ha (0.25 kg/acre) + 1 kg/ha (0.4 kg/acre)	· **Established plantings.** · Registered on **CHERRIES ONLY**. · Apply only once in the year of planting. · PRE – Apply as a band under trees before weeds emerge. · **Do NOT** use on soil coarser than sandy loam with less than 3% organic matter.
	SINBAR (80 WDG) + LEXONE DF (75DF)		
trifluralin (0.6–1.15 kg/ha)	TREFLAN EC (480 g/L)	1.2–2.4 L/ha (0.48–0.96 L/acre)	· **Planting year ONLY.** · Apply **ONLY** once in the year of planting. · PPI – Apply and incorporate before planting trees. · Use at least 100 L/ha (40 L/acre) water. · Apply the higher rate on clay soils.
	BONANZA 480 (480 g/L)	1.25–2.3 L/ha (0.5–0.92 L/acre)	
Postemergence Grass Herbicides			
sethoxydim (0.14–0.5 kg/ha) + surfactant/solvent (0.25–2 L/ha)	POAST ULTRA (450 g/L) + MERGE	0.32–1.1 L/ha (0.13–0.44 L/acre) + 0.25–2 L/ha (0.1–0.8 L/acre)	· **New and established plantings.** · For annual grass, use 0.32 L/ha (0.13 L/acre). Apply at the 1–6 leaf stage. · For volunteer grains, use 0.47 L/ha (0.19 L/acre. · For quackgrass, use 1.1 L/ha (0.44 L/acre. Apply up to the 3 leaf stage. · **Do NOT** apply closer than 30 days to harvest. · **Do NOT** apply if rain is expected within 1 h after application.

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
CHERRIES AND PLUMS (cont'd)			
Postemergence Grass Herbicides (cont'd)			
fluazifop-p-butyl (0.075–0.25 kg/ha)	VENTURE L (125 g/L)	0.6–2 L /ha (0.24–0.8 L/acre)	· **Established plantings ONLY.** · Apply post to actively growing grasses before tillering. · Apply at 0.6 L/ha (0.24 L/acre) at 2–5 leaf stage of volunteer corn. · Apply at 0.8 L/ha (0.32 L/acre) at 2–5 leaf stage of volunteer wheat and barley. · Apply at 1 L/ha (0.4 L/acre) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails). · Apply at 2 L/ha (0.8 L/acre) at 3–5 leaf stage of quackgrass and wirestem muhly. · Grasses emerging after the treatment will not be controlled. · Apply **ONLY** once per year.
Postemergence Broadleaf Herbicides			
2,4-D (0.95 kg/ha)	2,4-D (470 g/L)	2 L/ha (0.8 L/acre)	· **Established plantings.** · For broadleaf weeds, including dandelion, seedling Canada thistle and sow-thistle. · Apply in early spring after weeds emerge or postharvest to actively growing weeds. · **Do NOT** apply closer than 80 days to harvest.
	2,4-D (564 g/L)	1.68 L/ha (0.67 L/acre)	
	2,4-D (660 g/L)	1.44 L/ha (0.58 L/acre)	
carfentrazone-ethyl (8.8–36 g/ha) + non-ionic surfactant (0.25% v/v)	AIM EC (240 g/L) + AGRAL 90	36.5–150 mL/ha (14.8–60 mL/acre) + 2.5 L/1,000 L	· **New and established plantings.** · Apply POST with a hooded sprayer between the rows. · Apply to actively growing weeds up to 10 cm tall. · Apply to basal shoots (suckers) before they have a hardened bark. · Use a higher rate of 150 mL/ha (60 mL/acre) for control of suckers. · Apply in 200 L/ha (80 L/acre) water. · **Do NOT** apply closer than 30 days to harvest. · **Do NOT** exceed two applications a year. · Severe crop injury may result if the spray is allowed to come in contact with the green bark, leaves, bloom or fruit.
	AIM EC (240 g/L) + AG-SURF		
carfentrazone-ethyl (8.8–36 g/ha) + surfactant/solvent (0.1% v/v)	AIM EC (240 g/L) + MERGE	36.5–150 mL/ha (14.8–60 mL/acre) + 1 L/1,000 L	
bentazon (0.84–1.08 kg/ha) + oil concentrate (1–2 L/ha)	BASAGRAN (480 g/L) + ASSIST	1.75–2.25 L/ha (0.7–0.9 L/acre) + 1–2 L/ha (0.4–0.8 L/acre)	· **Planting year ONLY.** · Registered on **CHERRIES ONLY.** · Tolerant as a directed spray only. **Do NOT** overspray. · Avoid tree leaves. · Apply in 100–400 L/ha (40–160 L/acre) water with at least 275 kPa pressure. · Use lower rate of assist under hot, humid conditions. · During the planting year, make a maximum of two applications per season, 10 days apart and at the low rate only.
clopyralid (0.15–0.30 kg/ha)	LONTREL 360 (360 g/L)	0.42–0.83 L/ha (0.17 – 0.34 L/acre)	· **New and established plantings** · For control of broadleaf weeds including vetch at the early flowering stage. · For best results apply in the spring as a spot treatment when cherries and plums are flowering. · Apply 42– 83 mL per 1000 m2 in 300 L of water when using a hand gun or back pack sprayer. · Avoid contact with tree limbs. · **Do NOT** apply closer than 30 days to harvest.

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
CHERRIES AND PLUMS (cont'd)			
Non-Selective Herbicides and Tank Mix Options			
Indaziflam (0.0758 kg/ha) + paraquat (1.1 kg/ha)	ALION (200 g/L) + GRAMOXONE (200 g/L)	0.375 L/ha (0.152 L/acre) + 5.5 L/ha (2.2 L/acre)	· Apply **ONLY** to crops that have been established for at least three full growing seasons · Do not apply prior to any type of soil disturbance · Apply only once per growing season. · Excessive crop or weed debris present on soil surface at time of application may prevent uniform product distribution reaching the soil and result in reduced weed control
glyphosate (0.81–4.32 kg/ha)	glyphosate (360 g/L)*	2.25–12 L/ha (0.9–4.8 L/acre)	· **Established plantings ONLY.** · For actively growing weeds. · Apply in 200–300 L/ha (80–120 L/acre) water as a directed spray. · Remove all suckers from base of trunks two weeks before application. · **Do NOT** apply to trees with green bark in the area of application. · **Do NOT** mow or till weeds for at least 5–7 days after application. Wait longer if cool. · Only weeds emerged at application time will be controlled. Additional weed control programs will be necessary to control weeds germinating later. · Repeat application to regrowth may be necessary for complete control. · **Do NOT** apply closer than 30 days to harvest. · For specific information on product rates and notes for annual and perennial weed control refer to Table 6–3. Specific Notes on Weeds Controlled and Product Rates Associated with Various Glyphosate Concentrations, page 94. * See Table 4–1. Herbicides Used In Ontario, page 30, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.
	glyphosate (480 g/L)*	1.69–9 L/ha (0.68–3.6 L/acre)	
	glyphosate (500 g/L)*	1.62–8.64 L/ha (0.65–3.5 L/acre)	
	glyphosate (540 g/L)*	1.5–8 L/ha (0.6–3.2 L/acre)	
glyphosate (0.36 kg/2 L)	glyphosate (360 g/L)*	1 L/2 L water	· **Established plantings ONLY.** · Apply with a rope wick or other similar device when weeds are at the optimum stage. · Avoid contact with leaves, trunks and suckers. · **Do NOT** apply when weeds are wet. · See Wick Wiper and Roller Application, page 100. · **Do NOT** apply closer than 30 days to harvest. * See Table 4–1. Herbicides Used In Ontario, page 30, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.
	glyphosate (480 g/L)*	0.75 L/2 L water	
	glyphosate (500 g/L)*	0.72 L/2 L water	
	glyphosate (540 g/L)*	0.67 L/2 L water	
glyphosate* (0.36–0.72 kg/100 L)	glyphosate (360 g/L)*	1–2 L/100 L water	· **Established plantings ONLY.** · Use hand held sprayers as a spot treatment if wiper equipment is not available. · Avoid contact with leaves, trunks and suckers. · **Do NOT** apply closer than 30 days before harvest. * See Table 4–1. Herbicides Used In Ontario, page 30, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.
	glyphosate (480 g/L)*	0.75–1.5 L/100 L water	
	glyphosate (500 g/L)*	0.72–1.44 L/100 L water	
	glyphosate (540 g/L)*	0.67–1.34 L/100 L water	

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
CHERRIES AND PLUMS (cont'd)			
Non-Selective Herbicides and Tank Mix Options (cont'd)			
glyphosate (0.81–4.32 kg/ha) indaziflam (0.075 kg/ha)	glyphosate (360 g/L)* + ALION 200 SC (200 g/L)	2.25–12 L/ha (0.9–4.8 L/acre) + 0.375 L/ha (0.152 L/acre)	· **Established plantings ONLY.** · **Do NOT** apply to trees with green bark in the area of application. · **Do NOT** apply closer than 30 days to harvest. · Apply **ONLY** once per growing season. · Apply **ONLY** to crops that have been established for at least three full growing seasons. · For specific information on product rates and notes for annual and perennial weed control refer to Table 6–3. Specific Notes on Weeds Controlled and Product Rates Associated with Various Glyphosate Concentrations, page 94. · Consult the label of the tank mix partner(s) for further instructions regarding product rates, directions for use, restrictions, personal protective equipment and precautions. * See Table 4–1. Herbicides Used In Ontario, page 30, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.
	glyphosate (480 g/L)* + ALION 200 SC (200 g/L)	1.69–9 L/ha (0.68–3.6 L/acre) + 0.375 L/ha (0.152 L/acre)	
	glyphosate (500 g/L)* + ALION 200 SC (200 g/L)	1.62–8.64 L/ha (0.65–3.5 L/acre) + 0.375 L/ha (0.152 L/acre)	
	glyphosate (540 g/L)* + ALION 200 SC (200 g/L)	1.5–8 L/ha (0.6–3.2 L/acre) + 0.375 L/ha (0.152 L/acre)	
paraquat (1.1 kg/ha)	GRAMOXONE (200 g/L)	5.5 L/ha (2.2 L/acre)	· **Established plantings ONLY.** · Apply in 1,100 L/ha (440 L/acre) water. · For spot spraying, apply 55 mL in 10 L water sprayed to wet weed foliage. · Use on trees established 1 year or more. · Avoid contact with green tree bark, leaves or fruit. · May be tank-mixed with LOROX for trees established at least 10 years.
glufosinate ammonium (0.405–0.75 kg/ha)	IGNITE (150 g/L)	2.7–5 L/ha (1.08–2 L/acre)	· **Established plantings ONLY.** · Apply as a directed spray before weeds are 30 cm high. · Use 110–330 L/ha (44–132 L/acre) water. · Where weed growth is heavy, use the higher rate and larger water volume. · **Do NOT** apply closer than 40 days to harvest. · For trees established at least 1 year. · **Do NOT** make more than two applications a year. · **Do NOT** apply more than 6.7 L/ha (2.7 L/acre) of ignite in a year.
glufosinate ammonium (0.405–0.75 kg/ha) + indaziflam (0.075 kg/ha)	IGNITE (150 g/L) + ALION 200 SC (200 g/L)	2.7–5 L/ha (1.08–2 L/acre) + 0.375 L/ha (0.152 L/acre)	· **Established plantings ONLY.** · Apply as a directed spray before weeds are 30 cm high, when the ground is not frozen or snow covered. · Use 110–330 L/ha (44–132 L/acre) water. Where weed growth is heavy, use the higher rate and larger water volume. · **Do NOT** apply closer than 14 days to harvest. · Apply **ONLY** to crops that have been established for at least three full growing seasons. · Apply **ONLY** once per growing season. · Consult the label of the tank mix partner(s) for further instructions regarding product rates, directions for use, restrictions, personal protective equipment and precautions.

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	**TRADE NAME (concentration)**	**PRODUCT RATE**	**PRECAUTIONS** For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
GRAPES			
Site Preparation Before Planting – See Chapter 6, Preplant & Postharvest Weed Control, page 91.			
Cultural Weed Control – Cultural Weed Control in Tree Fruit and Tree Nut Crops, page 350 Hilling the vines at regular intervals throughout the year will aid in weed control. Be aware that this disruption of the soil will also disturb any residual herbicides. The use of cultivation, mulch or rye cover crops between the rows will provide better water penetration as well as aid in weed control. Cultivation after planting is needed to level the soil, and early establishment on trellises or stakes will minimize damage from cultivation. Hilling for winter protection can be started in late summer, and will control late germinating weeds. Removing of hills each spring will also aid in weed control. **Rates per hectare or per acre refer to area actually treated with herbicide. Unless specified, apply all treatments in 150–300 L/ha (60–120 L/acre) water.** **CAUTION** – simazine, KARMEX, DEVRINOL and SINBAR residues, high enough to harm many crops, may persist for several years after removal of vineyard.			
Soil Applied Grass and Broadleaf Herbicides			
Indaziflam (0.152 L/ac)	ALION 200 SC (200 g/L)	0.375 L/ha (0.0758 kg/ha)	· **Do NOT** apply to grapes that have been established for less than five full growing seasons after transplanting. · **Do NOT** apply prior to any type of soil disturbance, including hilling/dehilling. · Ensure that grapes have been planted at least 30cm deep or that there is 30 cm of soil barrier between the soil surface and the major portion of the root system · **Do NOT** harvest withing 14 days for ALION herbicide application · Apply only once per growing season. · Excessive crop or weed debris present on soil surface at time of application may prevent uniform product distribution reaching the soil and result in reduced weed control
dichlobenil (4.4–9 kg/ha)	CASORON G-4 (4 GR)	110–225 kg/ha (44–90 kg/acre)	· **Established plantings ONLY.** · PRE – Apply to cool moist but unfrozen soil in late fall or spring before weeds emerge. · **Do NOT** apply if air temperatures are above 10°C–15°C to avoid injury from volatilization. · Apply to dormant healthy vines only. · **Do NOT** apply to vines until they have been established for at least 2 full years. · For annual weeds, use 110–175 kg/ha (44–70 kg/acre). · For quackgrass, and broadleaf perennial weeds, use 175–225 kg/ha (70–90 kg/acre). · Use the higher rate of 225 kg/ha (90 kg/acre) only every other year.
flumioxazin (0.14–0.21 kg/ha)	CHATEAU WDG (51.1%)	0.28–0.42 kg/ha (0.11–0.16 kg/acre)	· **Established plantings ONLY.** · **Do NOT** apply to grapes established for less than 2 years. · Maximum 2 applications per growing season at least 30 days apart. · Apply the lower rate to coarse textured soils with less than 5% organic matter and apply the higher rate to medium textured soils with less than 5% organic matter. · **Do NOT** apply within 100 m of non-dormant pears. · Apply using ground application **ONLY.** · **Do NOT** apply after bud break unless using hooded or shielded equipment. · After use, tanks and nozzles must be cleaned with a 3% ammonia solution. Please review label for more detailed instructions. · **Do NOT** harvest within 60 days of application.

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
GRAPES (cont'd)			
Soil Applied Grass and Broadleaf Herbicides (cont'd)			
dimethenamid (0.69 kg/ha)	FRONTIER MAX (720 g/L)	0.963 L/ha (0.39 L/acre)	· New and established plantings. · **Do NOT** apply during bud swell, bud break or first flush of new growth. · **Do NOT** harvest within 30 days of application. · PRE – Rainfall is required within 7–10 days of application to achieve sufficient herbicide activation. · Single application directed under the vines. · **Do NOT** apply by air. · Apply with a minimum spray volume of 170 L/ha (68 L/acre).
diuron (1.8–5.36 kg/ha)	KARMEX (80 DF)	2.25–6.7 kg/ha (0.9–2.68 kg/acre)	· **Established plantings ONLY.** · PRE – Apply as a directed spray to a 1 m strip under vines before weeds emerge. · Apply in at least 300 L/ha (120 L/acre) water. · Use only in vineyards established for at least 3 years. · On soils low in clay or organic matter (1%–2%), use 2.25–3.25 kg/ha (0.9–1.3 kg/acre) of area actually sprayed on soil high in clay or organic matter use 3.25–6.75 kg/ha. · Apply just prior to germination and growth of annual weeds, usually in the spring. · It may be desirable to make a fall treatment or divide applications equally between fall and spring treatments. Do not exceed the above rates per year as injury may result. · When a second application is performed, observe a minimum interval of 90 days between the first application and retreatment. · May be tank-mixed with GRAMOXONE.
simazine (3.6–4.5 kg/ha)	PRINCEP NINE-T (90 WG)	4–5 kg/ha (1.6–2 kg/acre)	· **Established plantings ONLY.** · PRE – Apply after hills are removed, but before weeds emerge. · Apply in at least 300 L/ha (120 L/acre) water. · Use higher rates on perennial weeds and on loams and clay. · Use **ONLY** in vineyards established for at least 3 years. · May be tank-mixed with IGNITE and glyphosate. · After harvest, a second application may be made.
	SIMADEX (500 g/L)	7.2–9 L/ha (2.9–3.6 L/acre)	
	SIMAZINE 480 (480 g/L)	7.5–9.4 L/ha (3–3.76 L/acre)	
sethoxydim (0.14–0.5 kg/ha) + surfactant/solvent (0.25–2 L/ha)	POAST ULTRA (450 g/L) + MERGE	0.32–1.1 L/ha (0.13–0.44 L/acre) + 0.25–2 L/ha (0.1–0.8 L/acre)	· **New and established plantings.** · **Single postemergence application banded to the base of grape vines.** · For annual grass, use 0.32 L/ha (0.13 L/acre). Apply at the 1–6 leaf stage. · For volunteer grains, use 0.47 L/ha (0.19 L/acre). · For quackgrass, use 1.1 L/ha (0.44 L/acre). Apply up to the 3 leaf stage. · **Do NOT** apply closer than 30 days to harvest. · **Do NOT** apply if rain is expected within 1 h after application.

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used In Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
GRAPES (cont'd)			
Postemergence Grass Herbicides			
fluazifop-p-butyl (0.075–0.25 kg/ha)	VENTURE L (125 g/L)	0.6–2 L/ha (0.24–0.8 L/acre)	· **New, 2nd year non-bearing grapevines and established plantings.** · Apply post to actively growing grasses before tillering. · Apply as banded application to the base of the grape vine. · Apply at 0.6 L/ha (0.24 L/acre) at 2–5 leaf stage of volunteer corn. · Apply at 0.8 L/ha (0.32 L/acre) at 2–5 leaf stage of volunteer wheat and barley. · Apply at 1 L/ha (0.4 L/acre) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails). · Apply at 2 L/ha (0.8 L/acre) at 3–5 leaf stage of quackgrass and wirestem muhly. · Grasses emerging after the treatment will not be controlled. · Apply **ONLY** once per year. · **Do NOT** harvest for 30 days after application.
Postemergence Broadleaf Herbicides			
carfentrazone-ethyl (8.8–36 g/ha) + non-ionic surfactant (0.25% v/v)	AIM EC (240 g/L) + AGRAL 90	36.5–150 mL/ha (14.6–60 mL/acre) + 2.5 L/1,000 L	· **New and established plantings.** · Apply post with a hooded sprayer between the rows. · Apply to actively growing weeds up to 10 cm tall. · Apply to basal shoots (suckers) before they have hardened bark. · Apply the higher rate of 150 mL/ha (60 mL/acre) to control suckers. · Apply in 200 L/ha (80 L/acre) water. · **Do NOT** apply closer than 30 days to harvest. · **Do NOT** exceed two applications per growing season. · Severe crop injury may result if the spray is allowed to come in contact with the green bark, leaves, bloom or fruit.
	AIM EC (240 g/L) + AG-SURF		
carfentrazone-ethyl (8.8–36 g/ha) + surfactant/solvent (0.1% v/v)	AIM EC (240 g/L) + MERGE	36.5–150 mL/ha (14.6–60 mL/acre) + 1 L/1,000 L	
Non-Selective Herbicides and Tank Mix Options			
Indaziflam (0.0758 kg/ha) + glufosinate ammonium (0.405–0.75 kg/ha)	ALION (200 g/L) + IGNITE (150 g/L)	0.375 L/ha (0.152 L/acre) + 2.7–5 L/ha (1.08–2 L/acre)	· **Do NOT** apply to grapes that have been established for less than five full growing seasons after transplanting. · **Do NOT** apply prior to any type of soil disturbance, including hilling/dehilling. · Ensure that grapes have been planted at least 30cm deep or that there is 30 cm of soil barrier between the soil surface and the major portion of the root system · Apply only once per growing season. · Excessive crop or weed debris present on soil surface at time of application may prevent uniform product distribution reaching the soil and result in reduced weed control
indaziflam (0.0758 kg/ha) + glyphosate (0.8–4.3 kg/ha)	ALION (200 g/L) + glyphosate	0.375 L/ha (0.152 L/acre) + 2.25–12 L/ha (0.9 - 4.8 L/acre)	· **Do NOT** apply to grapes that have been established for less than five full growing seasons after transplanting. · **Do NOT** apply prior to any type of soil disturbance, including hilling/dehilling. · Ensure that grapes have been planted at least 30cm deep or that there is 30 cm of soil barrier between the soil surface and the major portion of the root system · Apply only once per growing season. · Excessive crop or weed debris present on soil surface at time of application may prevent uniform product distribution reaching the soil and result in reduced weed control

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used In Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
GRAPES (cont'd)			
Non-Selective Herbicides and Tank Mix Options (cont'd)			
glyphosate (0.81–4.32 kg/ha)	glyphosate (360 g/L)*	2.25–12 L/ha (0.9–4.8 L/acre)	· **Established plantings ONLY.** · For actively growing weeds. · Apply in 200–300 L/ha (80–120 L/acre) water as a directed spray. · **Do NOT** use on vines less than 3 years old. · Direct spray to avoid leaves and green stems of grapevines. · **Do NOT** mow or till weeds for at least 5–7 days after application. Wait longer if the weather is cool. · **ONLY** weeds emerged at application time will be controlled. Additional weed control programs will be necessary to control weeds germinating later. · Repeat application to regrowth may be necessary for complete control. · **Do NOT** apply closer than 14 days to harvest. · For specific information on product rates and notes for annual and perennial weed control refer to Table 6–3. Specific Notes on Weeds Controlled and Product Rates Associated with Various Glyphosate Concentrations, page 94. * See Table 4–1. Herbicides Used In Ontario, page 30, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.
	glyphosate (480 g/L)*	1.69–9 L/ha (0.68–3.6 L/acre)	
	glyphosate (500 g/L)*	1.62–8.64 L/ha (0.65–3.5 L/acre)	
	glyphosate (540 g/L)*	1.5–8 L/ha (0.6–3.2 L/acre)	
glyphosate (0.36 kg/2 L)	glyphosate (360 g/L)*	1 L/2 L water	· **Established plantings ONLY.** · Apply with a rope wick or other similar device when weeds are at the optimum stage. · Direct spray to avoid leaves and green stems of grapevines. · **Do NOT** apply when weeds are wet. · **Do NOT** use on vines less than 3 years old. · See Wick Wiper and Roller Application, page 100. · **Do NOT** apply closer than 14 days to harvest. * See Table 4–1. Herbicides Used In Ontario, page 30, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.
	glyphosate (480 g/L)*	0.75 L/2 L water	
	glyphosate (500 g/L)*	0.72 L/2 L water	
	glyphosate (540 g/L)*	0.67 L/2 L water	
glyphosate (0.36–0.72 kg/100 L)	glyphosate (360 g/L)*	1–2 L/100 L water	· **Established plantings ONLY.** · Use hand held sprayers as a spot treatment if wiper equipment is not available. · Direct spray to avoid leaves and green stems of grapevines. · **Do NOT** use on vines less than 3 years old. · **Do NOT** apply closer than 14 days before harvest. * See Table 4–1. Herbicides Used In Ontario, page 30, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.
	glyphosate (480 g/L)*	0.75–1.5 L/100 L water	
	glyphosate (500 g/L)*	0.72–1.44 L/100 L water	
	glyphosate (540 g/L)*	0.67–1.34 L/100 L water	

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
GRAPES (cont'd)			
Non-Selective Herbicides and Tank Mix Options (cont'd)			
glyphosate (0.81–4.32 kg/ha) + simazine (2.25–4.5 kg/ha)	glyphosate (360 g/L)* + PRINCEP NINE-T (90 WG)	2.25–12 L/ha (0.9–4.8 L/acre) + 2.5–5 kg/ha (1–2 kg/acre)	· **Established plantings of at least 3 years ONLY.** · Use as a directed spray avoiding leaves, suckers and green bark on vines. · Use higher rates for perennial weeds and heavy weed infestations. · To control emerged weeds with residual control of germinating annual weeds. · See precautions for glyphosate and simazine. · **Do NOT** use within 40 days of harvest. * See Table 4–1. Herbicides Used In Ontario, page 30, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.
	glyphosate (480 g/L)* + PRINCEP NINE-T (90 WG)	1.69–9 L/ha (4.17–3.64 L/acre) + 2.5–5 kg/ha (1–2 kg/acre)	
	glyphosate (500 g/L)* + PRINCEP NINE-T (90 WG)	1.62–8.64 L/ha (0.66–3.5 L/acre) + 2.5–5 kg/ha (1–2 kg/acre)	
	glyphosate (540 g/L)* + PRINCEP NINE-T (90 WG)	1.5–8 L/ha (0.61–3.24 L/acre) + 2.5–5 kg/ha (1–2 kg/acre)	
paraquat (1.1 kg/ha)	GRAMOXONE (200 g/L)	5.5 L/ha (2.2 L/acre)	· **Established plantings ONLY.** · Apply in 1,100 L/ha (440 L/acre) water. · For spot spraying, apply 55 mL in 10 L of water sprayed to wet weed foliage. · Use on vines established on trellises. · Avoid contact with green bark, leaves or fruit. · May be tank-mixed with KARMEX.
paraquat (1.1 kg/ha) + napropamide (4.5 kg/ha)	GRAMOXONE (200 g/L) + DEVRINOL DF (50 DF)	5.5 L/ha (2.2 L/acre) + 9 kg/ha (3.6 kg/acre)	· **Established plantings ONLY.** · Add DEVRINOL to tank first, then agitate and add GRAMOXONE. · Apply in 1,100 L/ha (440 L/acre) water. · Avoid contact with foliage, fruit, and green vine bark.
	GRAMOXONE (200 g/L) + DEVRINOL DF-XT (50 DF-XT)		
glufosinate ammonium (0.405–0.75 kg/ha)	IGNITE (150 g/L)	2.7–5 L/ha (1.08–2 L/acre)	· **Established plantings of at least 3 years ONLY.** · Apply as a directed spray before annual weeds are 30 cm high. · Avoid suckers and green bark. · Use 110–330 L/ha (44–132 L/acre) water. · Where weed growth is heavy, use the higher rate and larger water volume. · **Do NOT** apply closer than 40 days to harvest. · **Do NOT** apply more than twice a year. · **Do NOT** apply more than 6.7 L/ha (2.7 L/acre) of product a year.
glufosinate ammonium (0.405–0.75 kg/ha) + simazine (3.6–4.5 kg/ha)	IGNITE (150 g/L) + PRINCEP NINE-T (90 WG)	2.7–5 L/ha (1.08–2 L/acre) + 4–5 kg/ha (1.6–2 kg/acre)	· **Established plantings of at least 3 years ONLY.** · For vines established at least 3 years. · Use as a directed spray avoiding leaves, suckers and green bark on vines. · To control emerged weeds with residual control of germinating annual weeds. · See precautions for IGNITE and simazine. · **Do NOT** harvest until 40 days after application.
	IGNITE (150 g/L) + SIMADEX (500 g/L)	2.7–5 L/ha (1.08–2 L/acre) + 7.2–9 L/ha (2.88–3.6 L/acre)	

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
PEACHES			
Site Preparation Before Planting – See Chapter 6, Preplant & Postharvest Weed Control, page 91.			
Rates per hectare or per acre refer to area actually treated with herbicide. unless specified, apply all treatments in 150–300 L/ha (60–120 L/acre) water.			
CAUTION – simazine, DEVRINOL and SINBAR residues, high enough to harm many crops, may persist for several years after removal of orchard.			
Soil Applied Grass and Broadleaf Herbicides			
indaziflam (0.075 kg/ha)	ALION 200 SC (200 g/L)	0.375 L/ha (0.152 L/acre)	· **Established plantings ONLY.** · PRE to weeds. Apply to soil before weeds germinate. If weeds have emerged, this product may be tank-mixed with a burndown herbicide (consult label for further instructions). · May be applied at anytime throughout the growing season when the ground is not frozen or snow covered. · Excessive crop or weed debris present on the soil surface at time of application may prevent uniform product distribution reaching the soil and result in reduced weed control. · Apply **ONLY** once per growing season. · Apply **ONLY** to crops that have been established for at least three full growing seasons.
dichlobenil (4.4–7 kg/ha)	CASORON G-4 (4 GR)	110–175 kg/ha (44–70 kg/acre)	· **Established plantings ONLY.** · PRE – Apply to cool, moist soil in spring before weeds emerge or after cultivation. · **Do NOT** apply if air temperatures are above 10°C–15°C to avoid injury from volatilization. · **Do NOT** apply until 4 weeks after transplanting. · **Do NOT** use on light sandy soils. · 70 g applied to an area 2×2 m is equivalent to 175 kg/ha (70 kg/acre).
flumioxazin (0.14–0.21 kg/ha)	CHATEAU WDG (51.1%)	0.28–0.42 kg/ha (0.11–0.17 kg/acre)	· **Established plantings ONLY.** · Maximum 2 applications per growing season at least 30 days apart. · **Do NOT** apply within 100 m of non-dormant pears. · Apply using ground application **ONLY**. · **Do NOT** apply to trees established less than 2 years. · **Do NOT** apply during the period after flowering through leaf drop unless using hooded or shielded equipment. · After use, tanks and nozzles must be cleaned with a 3% ammonia solution. Please review label for more detailed instructions. · **Do NOT** apply within 60 days of harvest.
napropamide (4.5 kg/ha)	DEVRINOL DF (50 DF) DEVRINOL DF-XT (50 DF-XT)	9 kg/ha (3.6 kg/acre)	· **Established plantings ONLY.** · PRE – Incorporation by rainfall or irrigation is essential. · Apply in the fall through early spring before weeds emerge, but not on frozen ground. · Avoid contact with fruit and foliage.
napropamide (3.5 kg/ha) + simazine (2 kg/ha)	DEVRINOL DF (50 DF) + PRINCEP NINE-T (90 WG) DEVRINOL DF-XT (50 DF-XT) + PRINCEP NINE-T (90 WG)	7 kg/ha (2.8 kg/acre) + 2.25 kg/ha (0.9 kg/acre)	· **Planting year ONLY.** · PRE – Apply in the fall through early spring before weeds emerge. · **Do NOT** apply on frozen ground or during harvest. · Make **ONLY** 1 application in the planting year. · Incorporation by rainfall or irrigation is essential within 2 days of application.

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS **For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.**
PEACHES (cont'd)			
Soil Applied Grass and Broadleaf Herbicides (cont'd)			
napropamide (4.5 kg/ha) + terbacil (0.48 kg/ha)	DEVRINOL DF (50 DF) + SINBAR (80 WP) DEVRINOL DF (50 DF) + SINBAR (80 WDG) DEVRINOL DF-XT (50 DF-XT) + SINBAR (80 WP) DEVRINOL DF-XT (50 DF-XT) + SINBAR (80 WDG)	9 kg/ha (3.6 kg/acre) + 0.6 kg/ha (0.24 kg/acre)	· **Planting year ONLY.** · PRE – Apply in the fall through early spring before weeds emerge. · **Do NOT** apply on frozen ground or during harvest. · Make **ONLY** 1 application in the planting year. · Incorporation by rainfall or irrigation is essential within 2 days of application.
s-metolachlor/ benoxacor (1.6 kg/ha)	DUAL II MAGNUM (915 g/L)	1.75 L/ha (0.7 L/acre)	· **Established plantings.** · PRE – Apply once per year as a band treatment under the trees before weeds emerge. · Avoid contact with trunk and leaves of trees. · **Do NOT** use on sandy soil with less than 2% organic matter.
s-metolachlor/ benoxacor (1.6 kg/ha) + metribuzin (0.75 kg/ha)	DUAL II MAGNUM (915 g/L) + LEXONE DF (75 DF)	1.75 L/ha (0.7 L/acre) + 1 kg/ha (0.4 kg/acre)	· **Established plantings.** · PRE – Apply once per year as a band treatment under the trees before weeds emerge. · Avoid contact with trunk and leaves of trees. · **Do NOT** use on sandy soil with less than 3% organic matter.
s-metolachlor/ benoxacor (1.14–1.6 kg/ha) + simazine (1–2.25 kg/ha)	DUAL II MAGNUM (915 g/L) + PRINCEP NINE-T (90 WG)	1.25–1.75 L/ha (0.5–0.7 L/acre) + 1.1–2.5 kg/ha (0.44–1 kg/acre)	· **New and established plantings.** · PRE – Apply post planting, before weeds emerge, preferably after rain has settled the soil around the trees. · Apply once in the year of planting. · **Do NOT** use on sandy soils with less than 2% organic matter. · Avoid contact with tree trunks and leaves. · Use high rate on established plantings.
metribuzin (0.38–0.75 kg/ha)	LEXONE DF (75DF)	0.5–1 kg/ha (0.2–0.4 kg/acre)	· **New and established plantings.** · PPI – Apply and incorporate before planting trees. Make a single application as a broadcast treatment or within the planting row. · PRE – Apply once per year as a band treatment under the trees before weeds emerge. · Avoid contact with tree trunks and leaves. · Use the higher rate on established plantings.
linuron (4.3 kg/ha)	LOROX DF (50 DF)	8.6 kg/ha (3.44 kg/acre)	· **Established plantings only.** · PRE – Apply in 400–600 L/ha (160–240 L/acre) water as a directed spray before weeds are 10 cm high. · Use **ONLY** under peach trees established for over 1 year. · Avoid contact with fruit, foliage or tree bark with spray or drift. · Add a surfactant.

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
PEACHES (cont'd)			
Soil Applied Grass and Broadleaf Herbicides (cont'd)			
simazine (1–2 kg/ha)	PRINCEP NINE-T (90 WG)	1.1–2.2 kg/ha (0.44–0.88 kg/acre)	· **Planting year ONLY.** · PRE – Apply post planting, before weeds emerge, preferably after rain has settled the soil around the trees. · Apply once in the year of planting. · **Do NOT** use on sandy soils with less than 2% organic matter. · Avoid contact with tree trunks and leaves.
metribuzin (0.41–0.56 kg/ha) + trifluralin (0.6–1.155 kg/ha)	SENCOR 75 DF (75 WG) + TREFLAN EC 480 g/L)	0.55–0.75 kg/ha (0.22–0.3 kg/acre) + 1.2–2.4 L/ha (0.5–0.96 L/acre)	· **Planting year ONLY.** · PRE – Apply and incorporate before planting trees. · Apply only once in the year of planting. · Apply as a broadcast treatment or within the planting row. · Apply higher rates to clay soils.
	SENCOR 75 DF (75 WG) + BONANZA 480 (480 g/L)	0.55–0.75 kg/ha (0.22–0.3 kg/acre) + 1.25–2.3 L/ha (0.5–0.92 L/acre)	
terbacil (1 kg/ha)	SINBAR (80 WP)	1.25 kg/ha (0.5 kg/acre)	· **Planting year.** · PRE – Apply after planting trees, before weeds emerge. · **Do NOT** use on soils with less than 3% organic matter. · Avoid contact with tree trunks and leaves.
	SINBAR (80 WDG)		
terbacil (1.8–3.6 kg/ha)	SINBAR (80 WP)	2.25–4.5 kg/ha (0.9–1.8 kg/acre)	· **Established plantings.** · PRE – Apply in 1,000 L/ha (400 L/acre) water. · Use only under trees established for at least 3 years. · Apply as a band under the trees before weeds emerge. · **Do NOT** use on soils with less than 3% organic matter.
	SINBAR (80 WDG)		
terbacil (0.5 kg/ha) + metribuzin (0.75 kg/ha)	SINBAR (80 WP) + LEXONE DF (75DF)	0.63 kg/ha (0.25 kg/acre) + 1 kg/ha (0.4 kg/acre)	· **Established plantings.** · PRE – Apply as a band under trees before weeds emerge. · Use **ONLY** 1 application per year. · **Do NOT** use on soil coarser than sandy loam with less than 3% organic matter.
	SINBAR (80 WDG) + LEXONE DF (75DF)		
trifluralin (0.6–1.15 kg/ha)	TREFLAN EC (480 g/L)	1.2–2.4 L/ha (0.5–0.96 L/acre)	· **Planting year ONLY.** · PPI – Apply and incorporate before planting trees. · Use at least 100 L/ha (40 L/acre) water. · Apply as a broadcast treatment or within the planting row. · Apply **ONLY** once in the year of planting. · Apply the higher rate to clay soils.
	BONANZA 480 (480 g/L)	1.25–2.3 L/ha (0.5–0.92 L/acre)	
Postemergence Grass Herbicides			
sethoxydim (0.14–0.5 kg/ha) + surfactant/solvent (0.25–2 L/ha)	POAST ULTRA (450 g/L) + MERGE	0.32–1.1 L/ha (0.13–0.44 L/acre) + 0.25–2 L/ha (0.1–0.8 L/acre)	· **New and established plantings.** · For annual grass, use 0.32 L/ha (0.13 L/acre). Apply at the 1–6 leaf stage. · For volunteer grains, use 0.47 L/ha (0.19 L/acre). · For quackgrass, use 1.1 L/ha (0.44 L/acre). Apply up to the 3 leaf stage. · **Do NOT** apply closer than 30 days to harvest. · **Do NOT** apply if rain is expected within 1 hour after application.
fluazifop-p-butyl (0.075–0.25 kg/ha)	VENTURE L (125 g/L)	0.6–2 L/ha (0.24–0.8 L/acre)	· **Established plantings ONLY.** · Apply at 1 L/ha (0.4 L/acre) at 2–5 leaf stage of annual grasses, 2 leaf for foxtails. · Apply at 2 L/ha (0.8 L/acre) at 3–5 leaf stage of quackgrass and wirestem muhly. · Grasses emerging after the treatment will not be controlled. · Apply **ONLY** once per year.

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
PEACHES (cont'd)			
Postemergence Broadleaf Herbicides			
2,4-D (0.95 kg/ha)	2,4-D (470 g/L)	2 L/ha (0.8 L/acre)	· **Established plantings ONLY.** · For broadleaf weeds, including dandelion, seedling Canada thistle and sow-thistle. · Apply in early spring after weeds emerge or postharvest to actively growing weeds. · **Do NOT** apply closer than 80 days to harvest.
	2,4-D (564 g/L)	1.68 L/ha (0.67 L/acre)	
	2,4-D (660 g/L)	1.44 L/ha (0.58 L/acre)	
carfentrazone-ethyl (8.8–36 g/ha) + non-ionic surfactant (0.25% v/v)	AIM EC (240 g/L) + AGRAL 90	36.5–150 mL/ha (14.8–60 mL/acre) + 2.5 L/1,000 L	· **New and established plantings.** · Apply post with a hooded sprayer between the rows. · Apply to actively growing weeds up to 10 cm tall. · Apply to basal shoots (suckers) before they have a hardened bark. · Use a higher rate of 150 mL/ha (60 mL/acre) for control of suckers. · Apply in 200 L/ha (80 L/acre) water. · **Do NOT** apply closer than 30 days to harvest. · **Do NOT** exceed two applications a year. · Severe crop injury may result if the spray is allowed to come in contact with the green bark, leaves, bloom or fruit.
	AIM EC (240 g/L) + AG-SURF		
carfentrazone-ethyl (8.8–36 g/ha) + surfactant/solvent (0.1% v/v)	AIM EC (240 g/L) + MERGE	36.5–150 mL/ha (14.8–60 mL/acre) + 1 L/1,000 L	
bentazon (0.84–1.08 kg/ha) + oil concentrate (1–2 L/ha)	BASAGRAN (480 g/L) + ASSIST	1.75–2.25 L/ha (0.7–0.9 L/acre) + 1–2 L/ha (0.4–0.8 L/acre)	· **Planting year ONLY.** · Directed spray **ONLY. Do NOT** overspray. · Avoid tree leaves. · Apply in 100–400 L/ha (40–160 L/acre) water with at least 275 kPa pressure. · Use lower rate of assist under hot, humid conditions. · During the planting year, make a maximum of two applications per season, 10 days apart and at the low rate only.
clopyralid (0.15–0.30 kg/ha	LONTREL 360 (360 g/L)	0.42–0.83 L/ha (0.17 – 0.34 L/acre)	· **New and established plantings** · For control of broadleaf weeds including vetch at the early flowering stage. · For best results apply in the spring as a spot treatment when peaches are flowering. · Apply 42– 83 mL per 1000 m2 in 300 L of water when using a hand gun or back pack sprayer. · Avoid contact with tree limbs. · **Do NOT** apply closer than 30 days to harvest.
Non-Selective Herbicides and Tank Mix Options			
Indaziflam (0.0758 kg/ha) + paraquat (1.1 kg/ha)	ALION (200 g/L) + GRAMOXONE (200 g/L)	0.375 L/ha (0.152 L/acre) + 5.5 L/ha (2.2 L/acre)	· Apply **ONLY** to crops that have been established for at least three full growing seasons. · **Do NOT** apply prior to any type of soil disturbance. · Apply only once per growing season. · Excessive crop or weed debris present on soil surface at time of application may prevent uniform product distribution reaching the soil and result in reduced weed control.
Indaziflam (0.075 kg/ha) + metribuzin (0.72 kg/ha)	ALION (200 g/L) + SENCOR 480F (480 g/L)	0.375 L/ha (0.152 L/acre) + 1.5 L/ha (0.606 L/acre)	· **Established plantings only** · Pre-emergent weeds control plus residual control of annual broadleaf weeds. · Apply only once per season. · Apply only to crops that have been established for at least 3 years.
	ALION (200 g/L) + SENCOR 75 DF (75 WG)	0.375 L/ha (0.152 L/acre) + 1.0 kg/ha (0.404 kg/acre)	

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
PEACHES (cont'd)			
Non-Selective Herbicides and Tank Mix Options (cont'd)			
glyphosate (0.81–4.32 kg/ha)	glyphosate (360 g/L)*	2.25–12 L/ha (0.9–4.8 L/acre)	· **Established plantings ONLY.** · For actively growing weeds. · Apply in 200–300 L/ha (80–120 L/acre) water as a directed spray. · Remove all suckers from base of trunks two weeks before application. · **Do NOT** apply to trees with green bark in the area of application. · **Do NOT** mow or till weeds for at least 5–7 days after application. Wait longer if cool. · **ONLY** weeds emerged at application time will be controlled. Additional weed control programs will be necessary to control weeds germinating later. · Repeat application to regrowth may be necessary for complete control. · **Do NOT** apply closer than 30 days to harvest. · For specific information on product rates and notes for annual and perennial weed control refer to Table 6–3. Specific Notes on Weeds Controlled and Product Rates Associated with Various Glyphosate Concentrations, page 94. * See Table 4–1. Herbicides Used In Ontario,page 30, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.
	glyphosate (480 g/L)*	1.69–9 L/ha (0.68–3.6 L/acre)	
	glyphosate (500 g/L)*	1.62–8.64 L/ha (0.65–3.5 L/acre)	
	glyphosate (540 g/IL*	1.5–8 L/ha (0.6–3.2 L/acre)	
glyphosate (0.36 kg/2 L)	glyphosate (360 g/L)*	1 L/2 L water	· **Established plantings ONLY.** · Apply with a rope wick or other similar device when weeds are at the optimum stage. · Avoid contact with the leaves, trunks and suckers. · **Do NOT** apply when weeds are wet. · See Wick Wiper and Roller Application, page 100. · **Do NOT** apply closer than 30 days to harvest. * See Table 4–1. Herbicides Used In Ontario, page 30, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.
	glyphosate (480 g/L)*	0.75 L/2 L water	
	glyphosate (500 g/L)*	0.72 L/2 L water	
	glyphosate (540 g/L)*	0.67 L/2 L water	
glyphosate (0.36–0.72 kg/100 L)	glyphosate (360 g/L)*	1–2 L/100 L water	· **Established plantings ONLY.** · Use hand held sprayers as a spot treatment if wiper equipment is not available. · Avoid contact with leaves, trunks and suckers. · **Do NOT** apply closer than 30 days before harvest. * See Table 4–1. Herbicides Used In Ontario, page 30, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.
	glyphosate (480 g/L)*	0.75–1.5 L/100 L water	
	glyphosate (500 g/L)*	0.72–1.44 L/100 L water	
	glyphosate (540 g/L)*	0.67–1.34 L/100 L water	

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used In Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
PEACHES (cont'd)			
Non-Selective Herbicides and Tank Mix Options (cont'd)			
glyphosate (0.81–4.32 kg/ha) indaziflam (0.075 kg/ha)	glyphosate (360 g/L)* + ALION 200 SC (200 g/L)	2.25–12 L/ha (0.9–4.8 L/acre) + 0.375 L/ha (0.152 L/acre)	· **Established plantings ONLY.** · **Do NOT** apply to trees with green bark in the area of application. · **Do NOT** apply closer than 30 days to harvest. · Apply **ONLY** once per growing season. · Apply **ONLY** to crops that have been established for at least three full growing seasons. · For specific information on product rates and notes for annual and perennial weed control refer to Table 6–3. Specific Notes on Weeds Controlled and Product Rates Associated with Various Glyphosate Concentrations, page 94. · Consult the label of the tank mix partner(s) for further instructions regarding product rates, directions for use, restrictions, personal protective equipment and precautions. * See Table 4–1. Herbicides Used In Ontario, page 30 for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.
	glyphosate (480 g/L)* + ALION 200 SC (200 g/L)	1.69–9 L/ha (0.68–3.6 L/acre) + 0.375 L/ha (0.152 L/acre)	
	glyphosate (500 g/L)* + ALION 200 SC (200 g/L)	1.62–8.64 L/ha (0.65–3.5 L/acre) + 0.375 L/ha (0.152 L/acre)	
	glyphosate (540 g/L)* + ALION 200 SC (200 g/L)	1.5–8 L/ha (0.6–3.2 L/acre) + 0.375 L/ha (0.152 L/acre)	
paraquat (1.1 kg/ha)	GRAMOXONE (200 g/L)	5.5 L/ha (2.2 L/acre)	· **Established plantings ONLY.** · Apply in 1,100 L/ha (440 L/acre) water. · For spot spraying, apply 55 mL in 10 L of water sprayed to wet weed foliage. · Use on trees established 1 year or more. · Avoid contact with green bark, leaves or fruit. · May be used in mixtures with DEVRINOL.
paraquat (1.1 kg/ha) + napropamide (4.5 kg/ha)	GRAMOXONE (200 g/L) + DEVRINOL DF (50 DF)	5.5 L/ha (2.2 L/acre) + 9 kg/ha (3.6 kg/acre)	· **Established plantings ONLY.** · Add DEVRINOL to tank first then agitate and add GRAMOXONE. · Apply in 1,100 L/ha (440 L/acre) water. · Use on trees established 1 year or more. · Avoid contact with green bark, leaves or fruit.
	DEVRINOL DF-XT (50 DF-XT) + DEVRINOL DF (50 DF)		
glufosinate ammonium (0.405–0.75 kg/ha)	IGNITE (150 g/L)	2.7–5 L/ha (1.08–2 L/acre)	· **Established plantings ONLY.** · Apply as a directed spray before weeds are 30 cm high. · Use 110–330 L/ha (44–132 L/acre) water. · Where weed growth is heavy, use the higher rate and larger water volume. · **Do NOT** apply closer than 14 days to harvest. · **Do NOT** apply more than twice a year. · **Do NOT** apply more than 6.7 L/ha (2.7 L/acre) of product a year. · Avoid contact with foliage and green bark.
glufosinate ammonium (0.405–0.75 kg/ha) indaziflam (0.075 kg/ha)	IGNITE (150 g/L) + ALION 200 SC (200 g/L)	2.7–5 L/ha (1.08–2 L/acre) + 0.375 L/ha (0.152 L/acre)	· **Established plantings ONLY.** · Apply as a directed spray before weeds are 30 cm high, when the ground is not frozen or snow covered. · Use 110–330 L/ha (44–132 L/acre) water. Where weed growth is heavy, use the higher rate and larger water volume. · **Do NOT** apply closer than 40 days to harvest. · Apply **ONLY** to crops that have been established for at least three full growing seasons. · Apply **ONLY** once per growing season. · Consult the label of the tank mix partner(s) for further instructions regarding product rates, directions for use, restrictions, personal protective equipment and precautions.

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
PEARS			
Site Preparation Before Planting – See Chapter 6, Preplant & Postharvest Weed Control, page 91.			
Rates per hectare or per acre refer to area actually treated with herbicide. Unless specified, apply all treatments in 150–300 L/ha (60–120 L/ac) water. **CAUTION** – simazine, DEVRINOL and SINBAR residues, high enough to harm many crops, may persist for several years after removal of orchard.			
Soil Applied Grass and Broadleaf Herbicides			
indaziflam (0.075 kg/ha)	ALION 200 SC (200 g/L)	0.375 L/ha (0.152 L/acre)	· **Established plantings ONLY.** · PRE to weeds. Apply to soil before weeds germinate. If weeds have emerged, this product may be tank-mixed with a burndown herbicide (consult label for further instructions). · May be applied at anytime throughout the growing season when the ground is not frozen or snow covered. · Excessive crop or weed debris present on the soil surface at time of application may prevent uniform product distribution reaching the soil and reduced weed control. · Apply **ONLY** once per growing season. · Apply **ONLY** to crops that have been established for at least three full growing seasons.
dichlobenil (4.4–7 kg/ha)	CASORON G-4 (4 GR)	110–175 kg/ha (44–70 kg/acre)	· **Established plantings ONLY.** · PRE – Apply to cool, moist soil in spring before weeds emerge or after cultivation. · **Do NOT** apply if air temperatures are above 10–15°C to avoid injury from volatilization. · **Do NOT** apply until 4 weeks after transplanting. · **Do NOT** use on light sandy soils. · 70 g applied to an area 2×2 m is equivalent to 175 kg/ha (70 kg/acre).
flumioxazin (0.14–0.21 kg/ha)	CHATEAU WDG (51.1%)	0.28–0.42 kg/ha (0.11–0.17 kg/acre)	· **Established plantings ONLY.** · Apply to dormant pears **ONLY**. · Apply using ground application **ONLY**. · **Do NOT** apply to trees established less than 1 year. · After use, tanks and nozzles must be cleaned with a 3% ammonia solution. Please review label for more detailed instructions.
napropamide (4.5 kg/ha)	DEVRINOL DF (50 DF) DEVRINOL DF-XT (50 DF-XT)	9 kg/ha (3.6 kg/acre)	· **Established plantings ONLY.** · PRE – Apply in the fall through early spring before weeds emerge, but not on frozen ground. Avoid contact with fruit and foliage. · **Do NOT** apply when fruit is on the ground during harvest. · Incorporation by rainfall or irrigation is essential.
napropamide (3.5 kg/ha) + simazine (2 kg/ha)	DEVRINOL DF (50 DF) + PRINCEP NINE-T (90 WG) DEVRINOL DF-XT (50 DF-XT) + PRINCEP NINE-T (90 WG)	7 kg/ha (2.8 kg/acre) + 2.25 kg/ha (0.9 kg/acre)	· **Planting year ONLY.** · PRE – Apply in the fall through early spring before weeds emerge. · **Do NOT** apply on frozen ground or during harvest. · Make **ONLY** 1 application in the planting year. · Incorporation by rainfall or irrigation is essential within 2 days of application.

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
PEARS (cont'd)			
Soil Applied Grass and Broadleaf Herbicides (cont'd)			
napropamide (4.5 kg/ha) + terbacil (0.48 kg/ha)	DEVRINOL DF (50 DF) + SINBAR (80 WP) DEVRINOL DF (50 DF) + SINBAR (80 WDG) DEVRINOL DF-XT (50 DF-XT) + SINBAR (80 WP) DEVRINOL DF-XT (50 DF-XT) + SINBAR (80 WDG)	9 kg/ha (3.6 kg/acre) + 0.6 kg/ha (0.24 kg/acre)	· **Planting year ONLY.** · PRE – Apply in the fall through early spring before weeds emerge. · **Do NOT** apply on frozen ground or during harvest. · Make **ONLY** 1 application in the planting year. · Incorporation by rainfall or irrigation is essential within 2 days of application.
s-metolachlor/ benoxacor (1.6 kg/ha)	DUAL II MAGNUM (915 g/L)	1.75 L/ha (0.7 L/acre)	· **Established plantings ONLY.** · PRE – Apply once per year as a band treatment under the trees before weeds emerge. · Avoid contact with trunk and leaves of trees. · **Do NOT** use on sandy soil with less than 2% organic matter.
s-metolachlor/ benoxacor (1.6 kg/ha) + metribuzin (0.75 kg/ha)	DUAL II MAGNUM (915 g/L) + LEXONE DF (75 DF)	1.75 L/ha (0.7 L/acre) + 1 kg/ha (0.4 kg/acre)	· **Established plantings ONLY.** · PRE – Apply once per year as a band treatment under the trees before weeds emerge. · Avoid contact with trunk and leaves of trees. · **Do NOT** use on sandy soil with less than 3% organic matter.
s-metolachlor/ benoxacor (1.14–1.6 kg/ha) + simazine (1–2.25 kg/ha)	DUAL II MAGNUM (915 g/L) + PRINCEP NINE-T (90 WG)	1.25–1.75 L/ha (0.5–0.7 L/acre) + 1.1–2.5 kg/ha (0.44–1 kg/acre)	· **New and established non-bearing plantings.** · PRE – Apply once per year as a band treatment under the trees before weeds emerge, preferably after rain has settled the soil around the trees. · **Do NOT** use on sandy soils with less than 2% organic matter. · Avoid contact with tree trunks and leaves. · Use the high rate on established plantings. · Late season crabgrass and fall panicum may escape this treatment.
propyzamide (2.25 kg/ha)	KERB (50 WSP)	4.5 kg/ha (1.8 kg/acre)	· **Established plantings ONLY.** · PRE – Apply from late September to early November when soil is cool and moist but not frozen. · Use **ONLY** under pear trees established at least 1 year. · 4.5 kg/ha is equivalent to 45 g/100 m².
metribuzin (0.38–0.75 kg/ha)	LEXONE DF (75 DF)	0.5–1 kg/ha (0.2–0.4 kg/acre)	· **New and established plantings.** · PPI – Before planting trees. · PRE – Apply once per year as a band treatment under the trees before weeds emerge. · Avoid contact with tree trunks and leaves. · Use high rate on established plantings. · **Do NOT** use on soils that are coarser than sandy loams with less than 3% organic matter.
linuron (4.3 kg/ha)	LOROX DF (50 DF)	8.6 kg/ha (3.44 kg/acre)	· **Established plantings ONLY.** · PRE – Apply as directed spray before weeds are 10 cm high. · Apply in 400–600 L/ha (160–240 L/acre) water. Add a surfactant. · Avoid contact with fruit, foliage or tree bark with spray or drift. · Use **ONLY** under trees established at least 10 years.

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
PEARS (cont'd)			
Soil Applied Grass and Broadleaf Herbicides (cont'd)			
simazine (2.25–4.5 kg/ha)	PRINCEP NINE-T (90 WG)	2.5–5 kg/ha (1–2 kg/acre)	· **Established plantings ONLY.** · PRE – Apply in 300–1,000 L/ha (120–400 L/acre) water. · Use only under trees planted for 1 year or more. · Use the higher rate on perennial weeds such as quackgrass. · If weeds are emerged before application they can be controlled by either cultivating prior to application or combining simazine with glyphosate.
	SIMADEX (500 g/L)	4.5–9 L/ha (1.8–3.6 L/acre)	
	SIMAZINE 480 (480 g/L)	4.7–9.4 L/ha (1.88–3.76 L/acre)	
metribuzin (0.41–0.56 kg/ha) + trifluralin (0.6–1.15 kg/ha)	SENCOR 75 DF (75 WG) + TREFLAN EC (480 g/L)	0.55–0.75 kg/ha (0.22–0.3 kg/acre) + 1.2–2.4 L/ha (0.48–0.96 L/acre)	· **Planting year ONLY.** · PPI – Before planting trees as an orchard floor or planting row treatment. · Apply once in the planting year only. · Apply higher rates to clay soils.
	SENCOR 75 DF (75 WG) + BONANZA 480 (480 g/L)	0.55–0.75 kg/ha (0.22–0.3 kg/acre) + 1.25–2.3 L/ha (0.5–0.92 L/acre)	
terbacil (1 kg/ha)	SINBAR (80 WP)	1.25 kg/ha (0.5 kg/acre)	· **Planting year.** · PRE – Apply after planting trees, before weeds emerge. · **Do NOT** use on soils with less than 3% organic matter. · Avoid contact with tree trunks and leaves.
	SINBAR (80 WDG)		
terbacil (0.5 kg/ha) + metribuzin (0.75 kg/ha)	SINBAR (80 WP) + LEXONE DF (75DF)	0.63 kg/ha (0.25 kg/acre) + 1 kg/ha (0.4 kg/acre)	· **Established plantings.** · PRE – Apply as a band under trees before weeds emerge. · Use **ONLY** 1 application per year. · **Do NOT** use on soil coarser than sandy loam with less than 3% organic matter.
	SINBAR (80 WDG) + LEXONE DF (75DF)		
trifluralin (0.6–1.15 kg/ha)	TREFLAN EC (480 g/L)	1.2–2.4 L/ha (0.48–0.96 L/acre)	· **Planting year ONLY.** · PPI – Apply and incorporate before planting trees. · Use at least 100 L/ha (40 L/acre) water. · Apply as a broadcast treatment or within the planting row. · Apply **ONLY** once in the year of planting. · Apply higher rates to clay soils.
	BONANZA 480 (480 g/L)	1.25–2.3 L/ha (0.5–0.92 L/acre)	
Postemergence Grass Herbicides			
sethoxydim (0.14–0.5 kg/ha) + surfactant/solvent (0.25–2 L/ha)	POAST ULTRA (450 g/L) + MERGE	0.32–1.1 L/ha (0.13–0.44 L/acre) + 0.25–2 L/ha (0.1–0.8 L/acre)	· **New and established plantings.** · For annual grass, use 0.32 L/ha (0.13 L/acre). Apply at the 1–6 leaf stage. · For volunteer grains, use 0.47 L/ha (0.19 L/acre). · For quackgrass, use 1.1 L/ha (0.44 L/acre). Apply up to the 3 leaf stage. · **Do NOT** apply closer than 30 days to harvest.
fluazifop-p-butyl (0.075–0.25 kg/ha)	VENTURE L (125 g/L)	0.6–2 L/ha (0.24–0.8 L/acre)	· **New and established plantings.** · Apply post to actively growing grasses before tillering. · Apply at 0.8 L/ha (0.32 L/acre) at 2–5 stage of volunteer wheat and barley. · Apply at 1 L/ha (0.4 L/acre) at 2–5 leaf stage of annual grasses, 2 leaf for foxtails. · Apply at 2 L/ha (0.8 L/acre) at 3–5 leaf stage of quackgrass and wirestem muhly. · Grasses emerging after the treatment will not be controlled. · Apply **ONLY** once per year.

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
PEARS (cont'd)			
Postemergence Broadleaf Herbicides			
2,4-D (0.95 kg/ha)	2,4-D (470 g/L)	2 L/ha (0.8 L/acre)	· **Established plantings ONLY.** · For broadleaf weeds, including dandelion, seedling Canada thistle and sow-thistle. · Apply in early spring after weeds emerge or postharvest to actively growing weeds. · **Do NOT** apply closer than 80 days to harvest.
	2,4-D (564 g/L)	1.68 L/ha (0.67 L/acre)	
	2,4-D (660 g/L)	1.44 L/ha (0.58 L/acre)	
carfentrazone-ethyl (8.8–36 g/ha) + non-ionic surfactant (0.25% v/v)	AIM EC (240 g/L) + AGRAL 90	36.5–150 mL/ha (14.6–60 mL/acre) + 2.5 L/1,000 L	· **New and established plantings.** · Apply post with a hooded sprayer between the rows. · Apply to actively growing weeds up to 10 cm tall. · Apply to basal shoots (suckers) before the bark hardens. · To control basal suckers apply at the higher label rate of 150 mL/ha (60 mL/acre). · Apply in 200 L/ha (80 L/acre) water. · **Do NOT** apply closer than 30 days to harvest. · **Do NOT** exceed two applications per growing season. · Severe crop injury may result if the spray is allowed to come in contact with the green bark, leaves, bloom or fruit.
	AIM EC (240 g/L) + AG-SURF		
carfentrazone-ethyl (8.8–36 g/ha) + surfactant/solvent (0.1% v/v)	AIM EC (240 g/L) + MERGE	36.5–150 mL/ha (14.6–60 mL/acre) + 1 L/1,000 L	
bentazon (0.84–1.08 kg/ha) + oil concentrate (1–2 L/ha)	BASAGRAN (480 g/L) + ASSIST	1.75–2.25 L/ha (0.7–0.9 L/acre) + 1–2 L/ha (0.4–0.8 L/acre)	· **Planting year ONLY.** · Directed spray **ONLY. Do NOT** overspray. · Apply in 100–400 L/ha (40–160 L/acre) water with at least 275 kPa pressure. · Avoid tree leaves. · Use lower rate of assist under hot, humid conditions. · During the planting year, make a maximum of two applications per season, 10 days apart and at the low rate only.
Non-Selective Herbicides and Tank Mix Options			
Indaziflam (0.0758 kg/ha) + paraquat (1.1 kg/ha)	ALION (200 g/L) + GRAMOXONE (200 g/L)	0.375 L/ha (0.152 L/acre) + 5.5 L/ha (2.2 L/acre)	· Apply **ONLY** to crops that have been established for at least three full growing seasons · **Do NOT** apply prior to any type of soil disturbance · Apply only once per growing season. · Excessive crop or weed debris present on soil surface at time of application may prevent uniform product distribution reaching the soil and result in reduced weed control
Indaziflam (0.075 kg/ha) + metribuzin (0.72 kg/ha)	ALION (200 g/L) + SENCOR 480F (480 g/L)	0.375 L/ha (0.152 L/acre) + 1.5 L/ha (0.606 L/acre)	· **Established plantings only** · Pre-emergent weeds control plus residual control of annual broadleaf weeds · Apply only once per season · Apply only to crops that have been established for at least 3 years
	ALION (200 g/L) + SENCOR 75 DF (75 WG)	0.375 L/ha (0.152 L/acre) + 1.0 kg/ha (0.404 kg/acre)	

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
PEARS (cont'd)			
Non-Selective Herbicides and Tank Mix Options (cont'd)			
glyphosate (0.81–4.32 kg/ha)	glyphosate (360 g/L)*	2.25–12 L/ha (0.9–4.8 L/acre)	· **Established plantings ONLY.** · For actively growing weeds. · Apply in 200–300 L/ha (80–120 L/acre) water as a directed spray. · Remove all suckers from base of trunks before application. · **Do NOT** apply to trees with green bark in the area of application. · **Do NOT** mow or till weeds for at least 5–7 days after application. Wait longer if cool. · **ONLY** weeds emerged at application time will be controlled. Additional weed control programs will be necessary to control weeds germinating later. · Repeat application to regrowth may be necessary for complete control. · **Do NOT** apply closer than 30 days to harvest. · For specific information on product rates and notes for annual and perennial weed control refer to Table 6–3. Specific Notes on Weeds Controlled and Product Rates Associated with Various Glyphosate Concentrations, page 94. * See Table 4–1. Herbicides Used In Ontario, page 30, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.
	glyphosate (480 g/L)*	1.69–9 L/ha (0.68–3.6 L/acre)	
	glyphosate (500 g/L)*	1.62–8.64 L/ha (0.65–3.5 L/acre)	
	glyphosate (540 g/L)*	1.5–8 L/ha (0.6–3.2 L/acre)	
glyphosate (0.36 kg/2 L)	glyphosate (360 g/L)*	1 L/2 L water	· **Established plantings ONLY.** · Apply with a rope wick or other similar device when weeds are at the optimum stage. · Avoid contact with the leaves, trunks and suckers. · **Do NOT** apply when weeds are wet. · See Wick Wiper and Roller Application, page 100. · **Do NOT** apply closer than 30 days to harvest. * See Table 4–1. Herbicides Used In Ontario, page 30, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.
	glyphosate (480 g/L)*	0.75 L/2 L water	
	glyphosate (500 g/L)*	0.72 L/2 L water	
	glyphosate (540 g/L)*	0.67 L/2 L water	
glyphosate (0.36–0.72 kg/100 L)	glyphosate (360 g/L)*	1–2 L/100 L water	· **Established plantings ONLY.** · Use hand held sprayers as a spot treatment if wiper equipment is not available. · Avoid contact with leaves, trunks and suckers. · **Do NOT** apply closer than 30 days before harvest. * See Table 4–1. Herbicides Used In Ontario, page 30, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.
	glyphosate (480 g/L)*	0.75–1.5 L/100 L water	
	glyphosate (500 g/L*	0.72–1.44 L/100 L water	
	glyphosate (540 g/L)*	0.67–1.34 L/100 L water	

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
PEARS (cont'd)			
Non-Selective Herbicides and Tank Mix Options (cont'd)			
glyphosate (0.81–4.32 kg/ha) indaziflam (0.075 kg/ha)	glyphosate (360 g/L)* + ALION 200 SC (200 g/L)	2.25–12 L/ha (0.9–4.8 L/acre) + 0.375 L/ha (0.152 L/acre)	· **Established plantings ONLY.** · **Do NOT** apply to trees with green bark in the area of application. · **Do NOT** apply closer than 30 days to harvest. · Apply **ONLY** once per growing season. · Apply **ONLY** to crops that have been established for at least three full growing seasons. · For specific information on product rates and notes for annual and perennial weed control refer to Table 6–3. Specific Notes on Weeds Controlled and Product Rates Associated with Various Glyphosate Concentrations, page 94. · Consult the label of the tank mix partner(s) for further instructions regarding product rates, directions for use, restrictions, personal protective equipment and precautions. * See Table 4–1. Herbicides Used In Ontario, page 30, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.
	glyphosate (480 g/L)* + ALION 200 SC (200 g/L)	1.69–9 L/ha (0.68–3.6 L/acre) + 0.375 L/ha (0.152 L/acre)	
	glyphosate (500 g/L)* + ALION 200 SC (200 g/L)	1.62–8.64 L/ha (0.65–3.5 L/acre) + 0.375 L/ha (0.152 L/acre)	
	glyphosate (540 g/L)* + ALION 200 SC (200 g/L)	1.5–8 L/ha (0.6–3.2 L/acre) + 0.375 L/ha (0.152 L/acre)	
paraquat (1.1 kg/ha)	GRAMOXONE (200 g/L)	5.5 L/ha (2.2 L/acre)	· **Established plantings ONLY.** · Apply in 1,100 L/ha (440 L/acre) water. · For spot spraying, apply 55 mL in 10 L of water sprayed to wet weed foliage. · Use on trees established 1 year or more. · Avoid contact with green bark, leaves or fruit. · May be used in mixtures with DEVRINOL or PRINCEP.
paraquat (1.1 kg/ha) + napropamide (4.5 kg/ha)	GRAMOXONE (200 g/L) + DEVRINOL DF (50 DF)	5.5 L/ha (2.2 L/acre) + 9 kg/ha (3.6 kg/acre)	· **Established plantings ONLY.** · Add DEVRINOL to tank first then agitate and add GRAMOXONE. · Apply in 1,100 L/ha (440 L/acre) water. · Use on trees established 1 year or more. · Avoid contact with green bark, leaves or fruit.
	DEVRINOL DF-XT (50 DF-XT) + DEVRINOL DF (50 DF)		
paraquat (1.1 kg/ha) + simazine (1.8–2.25 kg/ha)	GRAMOXONE (200 g/L) + PRINCEP NINE-T (90 WG)	5.5 L/ha (2.2 L/acre) + 2–2.5 kg/ha (0.8–1 kg/acre)	· **Established plantings ONLY.** · To control emerged weeds and provide residual control of germinating weeds. · Use on trees established 1 year or more. · Avoid contact with green bark, leaves or fruit. · See precautions on GRAMOXONE, page 357 and PRINCEP, page 354.
glufosinate ammonium (0.405–0.705 kg/ha)	IGNITE (150 g/L)	2.7–5 L/ha (1.08–2 L/acre)	· **Established plantings ONLY.** · Apply as a directed spray before weeds are 30 cm high. · Use 110–330 L/ha (44–132 L/acre) water. · Where weed growth is heavy, use the higher rate and larger water volume. · **Do NOT** apply closer than 40 days to harvest. · For trees established at least 1 year. · **Do NOT** apply more than twice a year.

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
PEARS (cont'd)			
Non-Selective Herbicides and Tank Mix Options (cont'd)			
glufosinate ammonium (0.405–0.75 kg/ha) + indaziflam (0.075 kg/ha)	IGNITE (150 g/L) + ALION 200 SC (200 g/L)	2.7–5 L/ha (1.08–2 L/acre) + 0.375 L/ha (0.152 L/acre)	· **Established plantings ONLY.** · Apply as a directed spray before weeds are 30 cm high, when the ground is not frozen or snow covered. · Use 110–330 L/ha (44–132 L/acre) water. Where weed growth is heavy, use the higher rate and larger water volume. · **Do NOT** apply closer than 40 days to harvest. · Apply **ONLY** to crops that have been established for at least three full growing seasons. · Apply **ONLY** once per growing season. · Consult the label of the tank mix partner(s) for further instructions regarding product rates, directions for use, restrictions, personal protective equipment and precautions.
glufosinate ammonium (0.405–0.75 kg/ha) + simazine (1.8–4.5 kg/ha)	IGNITE (150 g/L) + PRINCEP NINE-T (90 WG)	2.7–5 L/ha (1.08–2 L/acre) + 2–5 kg/ha (0.8–2 kg/acre)	· **Established plantings ONLY.** · To control emerged weeds plus residual control of annual grasses and broadleaf weeds. · Use as a directed spray around the bases of trees established at least 1 year. · **Do NOT** apply closer than 40 days to harvest. · See precautions on IGNITE page 386 and simazine, page 383.
	IGNITE (150 g/L) + SIMADEX (500 g/L)	2.7–5 L/ha (1.08–2 L/acre) + 4.5–9 L/ha (1.8–3.6 L/acre)	
TREE NUTS (CHESTNUT, FILBERT, HAZELNUT, JAPANESE HEARTNUT, PECAN AND WALNUT)			
Soil Applied Broadleaf Herbicides			
halosulfuron (34–68 g/ha)	SANDEA (72.6 WG)	47–93 g/ha (19–38 g/acre)	· **Established plantings of one or more years ONLY.** · Use on chestnuts, filberts, hazelnuts, pecans, walnuts, beechnuts and butternuts **ONLY.** · Use as a directed spray avoiding contact with trunk, stems, roots or foliage or severe damage or death may occur. · On soils with less than 1% organic matter or on coarse soil with less than 18% clay and more than 65% sand, do not apply more than 70 g/ha (28 g/acre). · May be applied twice per year, allow a minimum of 21 days between applications · **Do NOT** apply more than 186 g/ha (75 g/acre) per season and 140 g/ha (56 g/acre) per season on soils with less than 1% organic matter or on coarse soil with less than 18% clay and more than 65% sand. · Use a minimum water volume of 150 L/ha (60 L/acre). · Rains greater than 2.5 cm within 5–7 days of application may cause temporary yellowing and delay development of crop. · **Do NOT** contact green tissue such as foliage, fruit or green bark. · **Do NOT** spray over top of plastic mulch. · **Do NOT** apply to gravely soils · **Do NOT** harvest within 1 day after application.

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
TREE NUTS (CHESTNUT, FILBERT, HAZELNUT, JAPANESE HEARTNUT, PECAN AND WALNUT) (cont'd)			
Soil Applied Broadleaf Herbicides (cont'd)			
indaziflam (0.075 kg/ha)	ALION 200 SC (200 g/L)	0.375 L/ha (0.152 L/acre)	· Apply **ONLY** once per growing season. · Apply **ONLY** to crops that have been established for at least three full growing seasons. · Apply to soil before weeds germinate. If weeds have emerged, this product may be tank-mixed with a burn down herbicide (consult label for further instructions). · May be applied at any time throughout the growing season when the ground is not frozen or snow covered. · Excessive crop or weed debris present on the soil surface at time of application may prevent uniform product distribution in the soil and result in reduced weed control.
flumioxazin (0.143–0.215 kg/ha)	CHATEAU WDG (51.1%)	0.280–0.420 kg/ha (0.113–0.170 kg/acre)	· **Established plantings ONLY.** · Maximum 2 applications per growing season at least 30 days apart. · Apply the lower rate to coarse textured soil with less than 5% organic matter and apply the higher rate to medium textured soil with less than 5% organic matter. · **Do NOT** apply within 100 m of non-dormant pears. · Apply using ground application only. · **Do NOT** apply to trees established less than 1 year, unless protected from spray contact by non-porous wraps, grow tubes or waxed containers. · **Do NOT** apply after bud break unless using hooded or shielded equipment. · After use, tanks and nozzles must be cleaned with a 3% ammonia solution. Please review label for more detailed instructions. · **Do NOT** harvest within 60 days of application.
simazine (2.25–4.5 kg/ha)	PRINCEP NINE-T (90 WG)	2.5–5 kg/ha (1–2 kg/acre)	· Use on filberts, hazelnuts and walnuts **ONLY**. · Use on Established plantings **ONLY**, planted for 1 year or more. · PRE – Apply in 300–1,000 L/ha (120–400 L/acre) water. · Apply the spray to the orchard floor, avoiding contact with fruit, foliage or stems. · **DO NOT** apply during periods of dead calm. Avoid application of this product when winds are gusty. **DO NOT** apply with spray droplets smaller than the American Society of Agricultural Engineers (ASAE) medium classification. Boom height must be 60 cm or less above the ground. · **DO NOT** apply by air. · Restricted-entry interval is 12 h.
	SIMADEX (500 g/L)	4.5–9 L/ha (1.8–3.6 L/acre)	
	SIMAZINE 480 (480 g/L)	4.7–9.4 L/ha (1.88–3.76 L/acre)	

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
TREE NUTS (CHESTNUT, FILBERT, HAZELNUT, JAPANESE HEARTNUT, PECAN AND WALNUT) (cont'd)			
Postemergence Broadleaf Herbicides			
halosulfuron (34–68 g/ha) + non-ionic surfactant (0.25% v/v)	SANDEA (72.6 WG) + non-ionic surfactant	47–93 g/ha (19–38 g/acre) + 2.5 L/1,000L	· **Established plantings of one or more years ONLY.** · Use on chestnuts, filberts, hazelnuts, pecans, walnuts, beechnuts and butternuts **ONLY**. · Use as a directed spray avoiding contact with trunk, stems, roots or foliage or severe damage or death may occur. · On soils with less than 1% organic matter or on coarse soil with less than 18% clay and more than 65% sand, do not apply more than 70 g/ha (28 g/acre). · May be applied twice per year, allow a minimum of 21 days between applications. · **Do NOT** apply more than 186 g/ha (75 g/acre) per season and 140 g/ha (56 g/acre) per season on soils with less than 1% organic matter or on coarse soil with less than 18% clay and more than 65% sand. · Use a minimum water volume of 150 L/ha (60 L/acre). · Rains greater than 2.5 cm within 5–7 days of application may cause temporary yellowing and delay development of crop. · **Do NOT** contact green tissue such as foliage, fruit or green bark. · **Do NOT** spray over top of plastic mulch. · **Do NOT** apply to gravely soils. · **Do NOT** harvest within 1 day after application.
Non-Selective Herbicides and Tank Mix Options			
glyphosate (0.81–4.32 kg/ha)	glyphosate (360 g/L)*	2.25–12 L/ha (0.9–4.8 L/acre)	· Use on established plantings **ONLY**. See labels for registered nut trees. · Use on actively growing weeds. · Apply in 200–300 L/ha (80–120 L/acre) water as a directed spray. · Remove all suckers from base of trunks two weeks before application. · **Do NOT** apply to trees with green bark in the area of application. · **Do NOT** mow or till weeds for at least 5–7 days after application. Wait longer if cool. · **ONLY** weeds emerged at application time will be controlled. Additional weed control programs will be necessary to control weeds germinating later. · Repeat application to regrowth may be necessary for complete control. · **Do NOT** apply closer than 14 days to harvest. · For specific information on product rates and notes for annual and perennial weed control refer to Table 6–3. Specific Notes on Weeds Controlled and Product Rates Associated with Various Glyphosate Concentrations, page 94. * See Table 4–1. Herbicides Used In Ontario, page 30, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.
	glyphosate (480 g/L)*	1.69–9 L/ha (0.68–3.6 L/acre)	
	glyphosate (500 g/L)*	1.62–8.64 L/ha (0.65–3.5 L/acre)	
	glyphosate (540 g/L)*	1.5–8 L/ha (0.6–3.2 L/acre)	
glyphosate (0.36 kg/2 L)	glyphosate (360 g/L)*	1 L/2 L water	· Use on established plantings **ONLY**. See labels for registered nut trees. · Apply with a rope wick or other similar device when weeds are at the optimum stage. · Avoid contact with the leaves, trunks and suckers. · **Do NOT** apply when weeds are wet. · See Wick Wiper and Roller Application, page 100. · **Do NOT** apply closer than 14 days to harvest. * See Table 4–1. Herbicides Used In Ontario page 30, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.
	glyphosate (480 g/L)*	0.75 L/2 L water	
	glyphosate (500 g/L)*	0.72 L/2 L water	
	glyphosate (540 g/L)*	0.67 L/2 L water	

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
TREE NUTS (CHESTNUT, FILBERT, HAZELNUT, JAPANESE HEARTNUT, PECAN AND WALNUT) (cont'd)			
Non-Selective Herbicides and Tank Mix Options (cont'd)			
glyphosate (0.36–0.72 kg/100 L)	glyphosate (360 g/L)*	1–2 L/100 L water	· Use on established plantings **ONLY**. See labels for registered nut trees. · Use hand held sprayers as a spot treatment if wiper equipment is not available. · Avoid contact with leaves, trunks and suckers. · **Do NOT** apply closer than 14 days before harvest. * See Table 4–1. Herbicides Used In Ontario, page 30, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.
	glyphosate (480 g/L)*	0.75–1.5 L/100 L water	
	glyphosate (500 g/L)*	0.72–1.44 L/100 L water	
	glyphosate (540 g/L)*	0.67–1.34 L/100 L water	
glyphosate (0.81–4.32 kg/ha) + indaziflam (0.075 kg/ha)	glyphosate (360 g/L)* + ALION 200 SC (200 g/L)	2.25–12 L/ha (0.9–4.8 L/acre) + 0.375 L/ha (0.152 L/acre)	· Apply **ONLY** to crops of filberts, hazelnuts, chestnuts, walnuts and Japanese heartnuts that have been established for at least three full growing seasons. · **Do NOT** apply to trees with green bark in the area of application. · **Do NOT** apply closer than 30 days to harvest. · Apply **ONLY** once per growing season. · For specific information on product rates and notes for annual and perennial weed control refer to Table 6–3. Specific Notes on Weeds Controlled and Product Rates Associated with Various Glyphosate Concentrations, page 94. · Consult the label of the tank mix partner(s) for further instructions regarding product rates, directions for use, restrictions, personal protective equipment and precautions. * See Table 4–1. Herbicides Used In Ontario, page 30, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.
	glyphosate (480 g/L)* + ALION 200 SC (200 g/L)	1.69–9 L/ha (0.68–3.6 L/acre) + 0.375 L/ha (0.152 L/acre)	
	glyphosate (500 g/L)* + ALION 200 SC (200 g/L)	1.62–8.64 L/ha (0.65–3.5 L/acre) + 0.375 L/ha (0.152 L/acre)	
	glyphosate (540 g/L)* + ALION 200 SC (200 g/L)	1.5–8 L/ha (0.6–3.2 L/acre) + 0.375 L/ha (0.152 L/acre)	
glyphosate (0.81–4.32 kg/ha) + halosulfuron (34–68 g/ha) + non-ionic surfactant (0.25% v/v)	glyphosate (360 g/L)* + SANDEA (72.6 WG) + non-ionic surfactant	2.25–12 L/ha (0.9–4.8 L/acre) + 47–93 g/ha (19–38 g/acre) + 2.5 L/1,000 L	· **Established plantings ONLY.** · Use on chestnuts, filberts, hazelnuts, pecans, walnuts, beechnuts and butternuts **ONLY**. · Use as a directed spray avoiding contact with trunk, stems, roots or foliage or severe damage or death may occur. · On soils with less than 1% organic matter or on coarse soil with less than 18% clay and more than 65% sand, do not apply more than 70 g/ha (28 g/acre). · May be applied twice per year, allow a minimum of 21 days between applications · **Do NOT** apply more than 186 g/ha (75 g/acre) per season and 140 g/ha (56 g/acre) per season on soils with less than 1% organic matter or on coarse soil with less than 18% clay and more than 65% sand. · Use a minimum water volume of 200–300 L/ha (80–120 L/acre). · Rains greater than 2.5 cm within 5–7 days of application may cause temporary yellowing and delay development of crop. · **Do NOT** contact green tissue such as foliage, fruit or green bark. · **Do NOT** mow or till weeds for at least 5–7 days after application. · **Do NOT** apply to gravely soils · **Do NOT** harvest within 14 days after application. * See Table 4–1. Herbicides Used In Ontario, page 30, for formulations available. Not all formulations are registered on all crops. See label for specific uses and rates.
	glyphosate (480 g/L)* + SANDEA (72.6 WG) + non-ionic surfactant	1.69–9 L/ha (0.68–3.6 L/acre) + 47–93 g/ha (19–38 g/acre) + 2.5 L/1,000 L	
	glyphosate (500 g/L)* + SANDEA (72.6 WG) + non-ionic surfactant	1.62–8.64 L/ha (0.65–3.5 L/acre) + 47–93 g/ha (19–38 g/acre) + 2.5 L/1,000 L	
	glyphosate (540 g/L)* + SANDEA (72.6 WG) + non-ionic surfactant	1.5–8 L/ha (0.6–3.2 L/acre) + 47–93 g/ha (19–38 g/acre) + 2.5 L/1,000 L	

TABLE 15–2. Herbicide Treatment Rates for Tree Fruit, Tree Nuts and Grapes (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
TREE NUTS (CHESTNUT, FILBERT, HAZELNUT, JAPANESE HEARTNUT, PECAN AND WALNUT) (cont'd)			
Non-Selective Herbicides and Tank Mix Options (cont'd)			
glufosinate ammonium (0.405–0.75 kg/ha)	IGNITE (150 g/L)	2.7–5 L/ha (1.08–2 L/acre)	· Use on established plantings **ONLY**. · **Do NOT** make more than two applications per year. · **Do NOT** apply more than 6.7 L/ha (2.7 L/acre) in one season. · Avoid contact of IGNITE with green bark, stems or foliage as injury may occur to trees. · Only trunks with callused, mature brown bark should be sprayed unless protected from spray contact by nonporous wraps, tree/bark guards, grow tubes or waxed containers. · Apply before weeds reach a height of 30 cm. Weeds that emerge after application will not be controlled. · Pre-harvest interval of 14 days.
glufosinate ammonium (0.405–0.75 kg/ha) + simazine (2.25–4.5 kg/ha)	IGNITE (150 g/L) + PRINCEP NINE-T (90 WG)	2.7–5 L/ha (1.08–2 L/acre) + 2.5–5 kg/ha (1–2 kg/acre)	· Use on established plantings of filberts, hazelnuts and walnuts **ONLY**. · To control emerged weeds plus residual control of annual grasses and broadleaf weeds. · Use as a directed spray around the bases of established trees once a year. · **Do NOT** apply closer than 40 days to harvest.
	IGNITE (150 g/L) + SIMADEX (500 g/L)	2.7–5 L/ha (1.08–2 L/acre) + 4.5–9 L/ha (1.8–3.6 L/acre)	

16. NURSERY & ORNAMENTAL CROPS

NOTES: Weed control ratings are given as 0–9 where 0 indicates no control, and 9 indicates 90%–100% control under ideal conditions. Ratings are subjective values based on best available information and given general comparisons based on use as described in this guide. Under unfavourable conditions (e.g., too dry, too wet, too cold or poor application) the herbicides may not be as effective as indicated. Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used. Please refer to product label for more information on registered weed species, product uses and precautions.

TABLE 16–1. Nursery Herbicide Weed Control Ratings

LEGEND: Numbers (0–9) = weed control ratings – = insufficient information available to make a rating Refer to product label for list of species controlled.

	Annual Grass					Annual Broadleaves							Perennial Weeds																		
Trade Name	**barnyard grass**	**crabgrass**	**fall panicum**	**foxtail**	**witchgrass**	**chickweed, common**	**groundsel**	**lady's-thumb**	**lamb's-quarters**	**mustards**	**pigweeds**	**ragweed**	**bindweeds**	**brome grass**	**chickweed, mouse-eared**	**dandelion**	**grape, wild**	**ground-ivy (creeping charlie)**	**horsetail**	**mallow**	**milkweed**	**nutsedge**	**plantains**	**poison-ivy**	**quackgrass**	**sow-thistle**	**stinging nettle**	**thistle, Canada**	**toadflax, yellow**	**vetches**	**virginia creeper**
Soil Applied Grass Herbicides																															
KERB	8	7	8	8	8	7	–	7	8	8	7	7	–	8	–	–	–	–	5	–	6	6	–	–	6	–	–	6	–	–	–
Soil Applied Broadleaf Herbicides																															
BROADSTAR	3	3	3	5	3	8	8	7	9	–	9	7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
GALLERY	–	–	–	–	–	–	–	–	8	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
SUREGUARD	3	3	3	5	3	8	8	7	9	–	9	7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
Soil Applied Grass and Broadleaf Herbicides																															
CASORON	7	6	6	6	7	8	8	8	8	8	8	8	7	5	7	7	5	6	8	–	–	7	7	–	7	7	–	7	–	7	–
DACTHAL W 75	8	8	8	8	8	8	0	0	8	2	6	4	–	–	8	7	–	–	–	–	–	0	0	–	0	–	–	–	–	–	–
DEVRINOL	8	9	8	8	8	7	7	6	8	5	8	7	5	8	–	5	–	–	5	–	5	6	–	–	5	5	–	5	–	5	–
DUAL II MAGNUM	9	9	9	9	9	–	–	2	7	2	8^2	4	–	0	–	–	–	–	–	–	–	8^2	–	–	0	–	–	–	–	–	–
ECOCLEAR	–	9	–	9	–	9	–	–	9	9	–	8	–	–	9	7	–	–	–	–	–	–	7	–	7	–	–	–	7	7	–
RONSTAR 2G	7	8	–	8	–	5	8	–	8	8	7	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
FRONTIER MAX	9	9	8	9	9	–	–	2	7	2	8^2	–	0	0	–	–	–	–	–	–	–	8^2	–	–	0	–	–	–	–	–	–

[1] Use higher rates for weeds larger than 15 cm tall or across.

[2] Use the high rate of herbicide for optimum control.

[3] Various formulations available, see Table 4–1. Herbicides Used in Ontario, page 30.

TABLE 16–1. Nursery Herbicide Weed Control Ratings (cont'd)

LEGEND: Numbers (0–9) = weed control ratings – = insufficient information available to make a rating Refer to product label for list of species controlled.

	Annual Grass					Annual Broadleaves							Perennial Weeds																		
Trade Name	**barnyard grass**	**crabgrass**	**fall panicum**	**foxtail**	**witchgrass**	**chickweed, common**	**groundsel**	**lady's-thumb**	**lamb's-quarters**	**mustards**	**pigweeds**	**ragweed**	**bindweeds**	**brome grass**	**chickweed, mouse-eared**	**dandelion**	**grape, wild**	**ground-ivy (creeping charlie)**	**horsetail**	**mallow**	**milkweed**	**nutsedge**	**plantains**	**poison-ivy**	**quackgrass**	**sow-thistle**	**stinging nettle**	**thistle, Canada**	**toadflax, yellow**	**vetches**	**virginia creeper**
Soil Applied Grass and Broadleaf Herbicides (cont'd)																															
SIMADEX **or** SIMAZINE 480 **or** PRINCEP NINE-T	8	7	6	8	8	8	8	9	9	9	9	8	5	8	–	5	–	–	5	–	0	6	–	–	6	5	–	5	–	0	–
TREFLAN **or** BONANZA **or** RIVAL	9	9	8	8	8	7	5	2	8	2	8	2	2	–	7	–	–	–	4	–	5	5	–	–	2	2	–	2	–	2	–
Postemergence Grass Herbicides																															
VENTURE L	8	8	8	8	9	0	0	0	0	0	0	0	–	8	3	3	3	3	–	3	–	–	3	3	8	–	3	–	3	3	3
Postemergence Broadleaf Herbicides																															
LONTREL	–	–	–	–	–	2	–	5	2	2	2	8	–	–	–	4	–	–	–	–	–	–	–	–	–	8	–	8		9	–
Postemergence Grass and Broadleaf Herbicides																															
TREFLAN **or** BONANZA **or** RIVAL	–	–	8	–	–	7	–	6	6	–	5	–	–	–	–	9	2	–	–	–	8	8	–	8	8	8	6	8		8	–
glyphosate[3]	9	9	9	9	9	9	9	9	9	9	9	9	8	8	9	8[1]	8	5	5	5	9	8[1]	9	9	9	9	5	9	–	5[1]	8

[1] Use higher rates for weeds larger than 15 cm tall or across.

[2] Use the high rate of herbicide for optimum control.

[3] Various formulations available, see Table 4–1. Herbicides Used in Ontario, page 30.

To convert kg/ha or L/ha to g/100 m² or mL/100 m² – Multiply by 10 and change units.
For example – 11 kg/ha becomes 110 g/100 m²
28.4 L/ha becomes 284 mL/100 m²

Preplant Incorporated (PPI) – Two incorporations at right angles operating at a depth of 10 cm using a double disk (7–10 km/h) or vibrating shank S-tine cultivator (10–13 km/h) are required unless otherwise stated. Cultivation-type equipment used for herbicide incorporation is known to spread perennial weeds to previously uninfested areas. Special attention should be directed toward machinery cleanliness, and/or treating fields with perennial weeds last.

Preemergence (PRE) – Rainfall of 15–20 mm within 7–10 days after application is necessary to activate preemergence treatments. Shallow cultivation, rotary hoeing or harrowing will control weed escapes and improve herbicide activity in the absence of rainfall.

Postemergence – Leaf stage of the weeds is critical for good weed control. Smaller weeds are generally easier to kill but there needs to be enough leaf surface to intercept the herbicide. Apply according to leaf stages specified on pesticide label. Crop stage is important to optimize crop safety. Adjuvants will frequently improve the weed control when used as directed. Weather or other conditions may influence the optimum rate of adjuvant, see the product label for more details. Always use appropriate drift management technology.

Warning – Refer to manufacturer's instructions for waiting period required after planting.

Warning – Certain species may be injured by the herbicides mentioned in this Chapter. Check manufacturer's directions for labeled species before use.

The ONnurserycrops blog provides the latest information on nursery and ornamental crops. Visit ONnurserycrops at www.onnurserycrops.wordpress.com.

TABLE 16–2. Herbicide Treatment Rates for Nursery and Ornamental Crops

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
HERBACEOUS ORNAMENTALS			
Site Preparation Before Planting – See Chapter 6, Preplant & Postharvest Weed Control, page 91.			
Soil Applied Grass and Broadleaf Herbicides			
chlorthal dimethyl (12.75 kg/ha)	DACTHAL W-75 (75 WP)	17 kg/ha (6.8 kg/acre)	· Apply at lining out, late fall or early spring in 340 L/ha (136 L/acre) water. · Applications should be made to soil recently cultivated to a uniform texture. · Rain or irrigation (1 cm) is needed to activate this herbicide. · **Do NOT** use on Germander, Telanthera, Ajuga, Mesembryantheum, Dianthus, Viola Phlox and Vinca minor.
s-metolachlor/ benoxacor (1.14–1.6 kg/ha)	DUAL II MAGNUM (915 g/L)	1.25–1.75 L/ha (0.5–0.7 L/acre)	· **Apply PRE or early POST.** · Apply **ONLY** once per year. · Apply in a minimum of 150–200 L/ha (60–80 L/acre) water. · Apply by ground application equipment **ONLY.** · To avoid plant injury, **Do NOT** apply DUAL II MAGNUM to seedbeds, cutting beds, or uprooted cuttings before transplanting or to plants until the soil is settled around their roots. · After applying onto foliage, irrigate plant to wash off DUAL II MAGNUM and reduce plant injury. · **Do NOT** apply to crop that will bear harvestable fruit within 1 year to avoid residues. · **Do NOT** apply in residential areas.
dimethenamid-p (544–693 g/ha)	FRONTIER MAX (720 g/L)	756–963 mL/ha (305–390 mL/acre)	· **Do NOT** apply during spring growth of conifers or injury to terminals may occur. · **Do NOT** treat plants grown for food or feed. · **Do NOT** apply more than 1 application per season. · **Do NOT** make over the top applications. · **Do NOT** apply during bud swell, bud break or at time of first flush of new growth. If newly budded or grafted rootstock, make an application using a shielded sprayer. Care must be taken to ensure there are no cracks in the soil where FRONTIER MAX could come in contact with the roots. · FRONTIER MAX will not control emerged weeds.
pendimethalin (1.68 kg/ha)	PROWL H2O (455 g/L)	3.7 L/ha (1.5 L/acre)	· **Do NOT** apply to newly-transplanted ornamentals and conifers until plants have been watered and soil has been thoroughly packed and settled around roots. · **Do NOT** make over-the-top applications. · **Do NOT** treat plants grown for food or feed. · Rainfall or irrigation required within 7 days of application. · Unusually cold, excessively wet, or hot and dry conditions that delay weed germination or extend weed germination over a long period of time can reduce weed control. · Avoid unintentional contact of spray solution with stone, wood, or other porous surfaces as staining may occur. Rinse surfaces immediately using a heavy spray of water to avoid staining. · See label for tolerant species.
trifluralin (0.6–1.155 kg/ha)	TREFLAN EC(480 g/L)	1.2–2.4 L/ha (0.5–0.96 L/acre)	· PPI – Must be incorporated before transplanting. · **Do NOT** use for seeded annuals. · Check the label for list of tolerant species. · Check the label for application rate as it varies with soil type. · Incorporate immediately after application and before planting. · Application and incorporation can be made 3 weeks prior to and up until planting.
	RIVAL EC (500 g/L)	1.2–2.3 L/ha (0.48–0.92 L/acre)	
	BONANZA 480 (480 g/L)	1.25–2.3 L/ha (0.5–0.92 L/acre)	

TABLE 16–2. Herbicide Treatment Rates for Nursery and Ornamental Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
HERBACEOUS ORNAMENTALS (cont'd)			
Herbaceous Ornamentals – Postemergent Grass Herbicides			
fluazifop-p-butyl (0.075–0.25 kg/ha)	VENTURE L (125 g/L)	0.6–2 L/ha (0.24–0.8 L/acre)	• For **Campanula** and **Sedum** – direct spray **ONLY** to avoid contact with crop. • Apply POST to actively growing grasses before tillering. • Apply at 0.6 L/ha (0.24 L/acre) at 2–5 leaf stage of volunteer corn. • Apply at 0.8 L/ha (0.32 L/acre) at 2–5 leaf stage of volunteer wheat and barley. • Apply at 1 L/ha (0.4 L/acre) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails). • Apply at 2 L/ha (0.8 L/acre) at 3–5 leaf stage of quackgrass and wirestem muhly. • Fragmenting quackgrass rhizomes by thorough preplant tillage improves control. • Many species are tolerant in field production only. Consult the label for list of tolerant species.
SHELTERBELTS (WINDBREAKS) ESTABLISHED			
Cultural Weed Control – See Cultural Weed Control in Tree Fruit and Tree Nut Crops, page 350.			
Site Preparation Before Planting – See Chapter 6, Preplant & Postharvest Weed Control, page 91.			
Soil Applied Grass and Broadleaf Herbicides			
dichlobenil (4.4–7 kg/ha)	CASORON 4G (4 Gr)	110–175 kg/ha (44–70 kg/acre)	• PRE – Apply in early spring or late fall. • Use the lower rate for spring application. • Use the high rate of 175 kg/ha (70 kg/acre) **ONLY** every other year. • Tolerant species include cedar, linden, maple, willow, caragana and ash. Reduce rates on lighter soils.
chlorthal dimethyl (12.75 kg/ha)	DACTHAL W-75 (75 WP)	17 kg/ha (6.8 kg/acre)	• Apply at lining out, late fall or early spring in 340 L/ha (136 L/acre) water. • Applications should be made to soil recently cultivated to a uniform texture. • Rain or irrigation (1 cm) is needed to activate this herbicide.
simazine (4–6.72 kg/ha)	PRINCEP NINE-T (90 WG)	4.48 kg/ha (1.79 kg/acre)	• PRE – Apply in 500 L/ha (200 L/acre) water. • Apply in the fall or spring prior to weed emergence or after emerged weeds have been removed. • Windbreak species must be established for at least 1 year. • Tolerant species include cedar, spruce, black walnut, white ash, green ash, elm, boxelder, maple and caragana. • Check label for species which will tolerate higher rates of simazine. Apply before buds break in spring. • Use the low rate for sandy soils or low organic matter soils. • Injury may occur with trees grown in saline soils.
	SIMAZINE 480 (480 g/L)	9.4–14 L/ha (3.76–5.6 L/acre)	
trifluralin (0.6–1.155 kg/ha)	TREFLAN EC(480 g/L)	1.2–2.4 L/ha (0.5–0.96 L/acre)	• PPI – Apply as a directed spray to the soil surface around the trees or shrubs. • Incorporate as closely as possible to the trees and shrubs without causing damage to their roots. • Apply higher rates (2.4 L/ha or 0.96 L/acre) to clay soils.
	BONANZA 480 (480 g/L)	1.25–2.3 L/ha (0.5–0.92 L/acre)	

TABLE 16–2. Herbicide Treatment Rates for Nursery and Ornamental Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4. Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
SHELTERBELTS (WINDBREAKS) ESTABLISHED (cont'd)			
Postemergent Grass Herbicides			
fluazifop-p-butyl (0.075–0.25 kg/ha)	VENTURE L (125 g/L)	0.6–2 L/ha (0.24–0.8 L/acre)	• Apply POST to actively growing grasses before tillering. • Apply at 0.6 L/ha (0.24 L/acre) at 2–5 leaf stage of volunteer corn. • Apply at 0.8 L/ha (0.32 L/acre) at 2–5 leaf stage of volunteer wheat and barley. • Apply at 1 L/ha (0.4 L/acre) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails). • Apply at 2 L/ha (0.8 L/acre) at 3–5 leaf stage of quackgrass and wirestem muhly. • Fragmenting quackgrass rhizomes by thorough preplant tillage improves control. • **Do NOT** cultivate between rows until 5 days after application.
Postemergent Grass and Broadleaf Herbicides			
glyphosate (0.27–4.32 kg/ha)	glyphosate (360 g/L)*	0.75–12 L/ha (0.3–4.8 L/acre)	• For actively growing weeds in the fall, or spring prior to emergence of any crop. • Allow 5–7 days translocation time after application before doing any tillage when conditions are good. If cool temperatures follow application, allow additional time for translocation to be completed before disturbing treated weeds. • Only weeds emerged at application time will be controlled. Additional weed control programs will be necessary to control weeds germinating later. • Repeat application to regrowth may be necessary for complete control. • For specific information on product rates and notes for annual and perennial weed control refer to Table 6–5. Postharvest Weed Control Ratings, page 97. * See Table 4–1. Herbicides Used in Ontario, page 30, for formulations available. See label for specific uses and rates.
	glyphosate (450 g/L)*	0.6–9.6 L/ha (0.24–3.84 L/acre)	
	glyphosate (480 g/L)*	0.56–9 L/ha (0.22–3.6 L/acre)	
	glyphosate (500 g/L)*	0.54–8.64 L/ha (0.22–3.5 L/acre)	
	glyphosate (540 g/L)*	0.67–8 L/ha (0.27–3.2 L/acre)	
SHELTERBELTS (WINDBREAKS) TRANSPLANTED			
Site Preparation Before Planting – See Chapter 6, Preplant & Postharvest Weed Control, page 91.			
Soil Applied Grass and Broadleaf Herbicides			
trifluralin (0.6–1.155 kg/ha)	TREFLAN EC(480 g/L)	1.25–2.4 L/ha (0.5–0.96 L/acre)	• PPI – Apply after cultivation, and incorporate after application. • Transplant the trees or shrubs so that most of their root system is placed below the treated layer of soil. • Apply higher rates (2.4 L/ha or 0.96 L/acre) to clay soils. • Apply and incorporate from 3 weeks prior to planting up until planting.
	RIVAL EC (500 g/L)	1.2–2.3 L/ha (0.48–0.92 L/acre)	
	BONANZA 480 (480 g/L)	1.25–2.3 L/ha (0.5–0.92 L/acre)	
Postemergent Grass Herbicides			
fluazifop-p-butyl (0.075–0.25 kg/ha)	VENTURE L (125 g/L)	0.6–2 L/ha (0.24–0.8 L/acre)	• Apply to actively growing grasses prior to tillering. • Apply at 0.6 L/ha (0.24 L/acre) at 2–5 leaf stage of volunteer corn. • Apply at 0.8 L/ha (0.32 L/acre) at 2–5 leaf stage of volunteer wheat and barley. • Apply at 1 L/ha (0.4 L/acre) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails). • Apply at 2 L/ha (0.8 L/acre) at 3–5 leaf stage of quackgrass and wirestem muhly. • Thorough preplant tillage, fragmenting quackgrass rhizomes improves control. • **Do NOT** cultivate between rows until 5 days after application.

TABLE 16–2. Herbicide Treatment Rates for Nursery and Ornamental Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
WOODY NURSERY STOCK – FIELD GROWN NURSERY STOCK			
Cultural Weed Control – See Cultural Weed Control in Tree Fruit and Tree Nut Crops, page 350.			
Mechanical weed control such as cultivation and hand hoeing will provide weed control in sensitive species as well as provide control of weed escapes. Cultivators are available which will work in between trees and in the row.			
Site Preparation Before Planting – See Chapter 6, Preplant & Postharvest Weed Control, page 91.			
WARNING – Refer to manufacturer's instructions for waiting period required after planting.			
WARNING – Certain types of woody nursery stock may be injured by the following herbicides. Check manufacturer's directions for labeled species/cultivars before use.			
Soil Applied Grass Herbicides			
propyzamide (1.5 kg/ha)	KERB (50 WP)	3 kg/ha (1.2 kg/acre)	· PRE – Apply in the late fall when the soil temperature is low but above freezing. · Soil moisture should be high. · This herbicide is absorbed through the roots.
s-metolachlor/ benoxacor (1.14–1.6 kg/ha)	DUAL II MAGNUM (915 g/L)	1.25–1.75 L/ha (0.5–0.7 L/acre)	· PRE – Apply in at least 150–200 L/ha (60–80 L/acre) water. · Apply to soil prior to bud break of nursery stock. · **Do NOT** apply within 4 weeks of bud burst or until the needles have hardened. · For use on poplar stoolbeds, white spruce, Norway spruce, black spruce, white pine, Jack pine and red pine seedlings in their second year or older. · May have postemergent properties if applied to weeds before they reach the 2 leaf stage.
Soil Applied Broadleaf Herbicides			
flumioxazin (143–214 g/ha)	SUREGUARD (51.1%)	280–420 g/ha (112–168 g/acre)	· For control in field-grown ornamental deciduous and coniferous trees, including Christmas trees and trees produced for reforestation. · Tolerant species include: *Abies balsamea, Abies fraseri, Acer ginnala, Fraxinus pennsylvanica, Picea pungens, Pseudotsuga menzesii, Syringa reticulata and Thuja occidentalis.* · For postemergence, apply the higher rate. Consult the product label. · **Do NOT** apply to fine-textured soils. · Application should be made to tilled, weed-free deciduous tree plantings. · **ONLY** apply to healthy established trees. · **Do NOT** incorporate into soil after application. · **Do NOT** apply to moist or wet plant foliage. · **Do NOT** make more than two applications in a growing season. · May be used to maintain bare-ground non-crop areas in and around ornamental nurseries and field-grown ornamentals. · Apply using ground equipment. · Wait a minimum of 8 weeks before reapplying.
isoxaben (0.75 kg/ha)	GALLERY (75 DF)	1 kg/ha (0.4 kg/acre)	· PRE – For use in bareroot and container conifer seedlings. · Apply prior to weed emergence in conifers, four or more weeks after crop germination and emergence. · Rainfall or irrigation is needed to activate the herbicide.

TABLE 16–2. Herbicide Treatment Rates for Nursery and Ornamental Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
WOODY NURSERY STOCK – FIELD GROWN NURSERY STOCK (cont'd)			
Soil Applied Grass and Broadleaf Herbicides			
dichlobenil (4.4–7 kg/ha)	CASORON 4G (4 Gr)	110–175 kg/ha (44–70 kg/acre)	• PRE – Apply in late fall or early spring. • Use lower rate for spring application. • **Do NOT** apply until 4 weeks after transplanting second year stock. • Reduce rate on lighter soil.
chlorthal dimethyl (12.75 kg/ha)	DACTHAL W-75 (75 WP)	17 kg/ha (6.8 kg/acre)	• Apply at lining out, late fall or early spring in 340 L/ha (136 L/acre) water. • Applications should be made to soil recently cultivated to a uniform texture. • Rain or Irrigation (1 cm) is needed to activate this herbicide.
napropamide (4.5 kg/ha)	DEVRINOL DF (50 DF)	9 kg/ha (3.6 kg/acre)	• PPI – Apply any time of the year to a clean cultivated soil surface or before weeds germinate. • Use only once prior to or during a growing season. • This herbicide must reach the zone of weed germination, either by mechanical incorporation or by adequate irrigation or precipitation. • Shallow incorporation to a chemical depth of 2.5–5.0 cm or an irrigation with sufficient water to wet the soil to depth of 5–10 cm should occur within 7 days of a spring or fall application and within 2 days of a summer application. • Fall applications will control weeds the following spring and summer. • Caution – Residues high enough to harm many crops may persist after repeated applications in perennial crops.
	DEVRINOL DF-XT (50 DF-XT)		
	DEVRINOL 10G (10 Gr)	45 kg/ha (18 kg/acre)	
napropamide (4.5 kg/ha) + simazine (1.1 kg/ha)	DEVRINOL DF (50 DF) + SIMAZINE 80W (80 WP)	9 kg/ha (3.6 kg/acre) + 1.37 kg/ha (0.55 kg/acre)	• PPI – Apply before weeds emerge on established plantings only. • Will provide additional control of broadleaf weeds. • See Precautions under DEVRINOL and simazine.
	DEVRINOL DF-XT (50 DF-XT) + SIMAZINE 80W (80 WP)		
simazine (2.25–6.75 kg/ha)	PRINCEP NINE-T (90 WG)	2.5–3.75 kg/ha (1–1.5 kg/acre)	• PRE – Apply before weeds emerge on established plantings only. • **Do NOT** replant nursery stock into treated soil after stock is removed. • **Do NOT** use around ornamental shrubs if ground cover or bedding plants will be planted. • **Caution** – Residues high enough to harm many crops may persist after repeated applications. • Use the low application rate of simazine on sandy or low organic matter soils. • Apply in 300 L/ha (120 L/acre) water.
	SIMADEX (500 g/L)	3.6–13.5 L/ha (1.44–5.4 L/acre)	
pendimethalin (1.68 kg/ha)	PROWL H2O (455 g/L)	3.7 L/ha (1.5 L/acre)	• **Do NOT** apply to newly-transplanted ornamentals and conifers until plants have been watered and soil has been thoroughly packed and settled around roots. • **Do NOT** make over-the-top applications. • **Do NOT** treat plants grown for food or feed. • Rainfall or irrigation is required within 7 days of application. • Unusually cold, excessively wet, or hot and dry conditions that delay weed germination or extend weed germination over a long period of time can reduce weed control. • Avoid unintentional contact of spray solution with stone, wood, or other porous surfaces as staining may occur. Rinse surfaces immediately using a heavy spray of water to avoid staining. • See label for tolerant species.
trifluralin (0.6–1.155 kg/ha)	TREFLAN EC (480 g/L)	1.2–2.4 L/ha (0.5–0.96 L/acre)	• PPI – Must be incorporated immediately after application, after a clean cultivation. • This treatment does not control ragweed, annual nightshade or mustards. • Lady's-thumb may also escape this treatment. • Incorporate as close as possible to plants.
	RIVAL EC (500 g/L)	1.2–2.3 kg/ha (0.48–0.92 kg/acre)	

TABLE 16–2. Herbicide Treatment Rates for Nursery and Ornamental Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
WOODY NURSERY STOCK – FIELD GROWN NURSERY STOCK (cont'd)			
Postemergent Grass Herbicides			
fluazifop-p-butyl (0.075–0.25 kg/ha)	VENTURE L (125 g/L)	0.6–2 L/ha (0.24–0.8 L/acre)	· Apply POST to actively growing grasses before tillering. · Apply at 0.6 L/ha (0.24 L/acre) at 2–5 leaf stage of volunteer corn. · Apply at 0.8 L/ha (0.32 L/acre) at 2–5 leaf stage of volunteer wheat and barley. · Apply at 1 L/ha (0.4 L/acre) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails). · Apply at 2 L/ha (0.8 L/acre) at 3–5 leaf stage of quackgrass and wirestem muhly. · Thorough preplant tillage, fragmenting quackgrass rhizomes improves control. · **Do NOT** cultivate between rows until 5 days after application. · Consult the label for list of tolerant and sensitive species. Use as a directed application in sensitive species to avoid contact with leaves and green tissue. Some blue junipers (e.g., Bar Harbour, Blue Acres and Blue Rug) can be injured by over-the-top applications. · **Caution** – There are differences between cultivars in sensitivity to VENTURE L (e.g., *Juniperus horizontalis* Blue Acres is sensitive while *Juniperus horizontalis Plumosa Compacta* is tolerant). · Test on samples of each cultivar not specifically listed on the label before using the herbicide or use as a directed application.
Postemergent Broadleaf Herbicides			
oxyfluorfen (0.12–0.24 kg/ha)	GOAL 2XL (240 g/L)	0.5–1 L/ha (0.2–0.4 L/acre)	· GOAL 2XL has been tested on balsam fir, fraser fir, white pine and white spruce. Goal 2XL may be applied to other non-listed conifer species, however, non-listed conifer species may vary in tolerance. First use of GOAL 2XL to any non-listed conifer species should be limited to a small area of each variety to confirm tolerance prior to adoption as a general field practice. · Repeat applications if necessary. · **Do NOT** apply to trees under stress. · Some temporary needle burn may occur. · **Do NOT** apply more than 2 L/ha (0.8 L/acre) a year.
Postemergent Grass and Broadleaf Herbicides			
2,4-D (0.470 kg/ha) + glyphosate (0.360 kg/ha)	2,4-D AMINE (470 g/L) + GLYFOS (360 g/L)*	1 L/ha (0.4 L/acre) + 1 L/ha (0.4 L/acre)	· Ground directed spray only. · Apply **ONLY** to balsam fir and fraser fir. · Trees must be at least 1.2 m high and spray should not touch the branches. · Apply once per year in June. · Apply in 100 L/ha (40 L/acre) water. * See Table 4–1. Herbicides Used in Ontario, page 30, for formulations available. See label for specific uses and rates.

TABLE 16–2. Herbicide Treatment Rates for Nursery and Ornamental Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
WOODY NURSERY STOCK – FIELD GROWN NURSERY STOCK (cont'd)			
Postemergent Grass and Broadleaf Herbicides (cont'd)			
amitrole (0.39–0.69 kg/ha)	AMITROL 240 (231 g/L)	1.7–3.0 L/ha (0.68–1.2 L/acre)	· To be applied **ONLY** on spruce (*Picea* spp.). · Apply postemergence to actively growing plants, good coverage is essential. · If weeds are mature, it is advisable to cut them and then spray the re-growth. · **Do NOT** disturb treated plants for 2 weeks after application. · **Do NOT** make postharvest applications after October 1. · To control quackgrass and Canada thistle, apply in the spring or fall to actively growing plants that are 15–20 cm tall. Wait 10–14 days and then plough or disk. · Apply in 200–500 L/ha (80–200 L/acre) water. Avoid application to the crop during periods of rapid shoot elongation in the spring. · Applications can be made in the first year (0.68 L/acre) in either seedbed or transplants, but only after the seedlings have set bud. · The rate may be increased to 3.0 L/ha (1.2 L/acre) for actively growing seedlings or transplant bareroot spruce beyond the first year.
glyphosate (0.27–4.32 kg/ha)	glyphosate (360 g/L)*	0.75–12 L/ha (0.3–4.8 L/acre)	· For actively growing weeds in the fall, or spring prior to emergence of any crop. · Allow 5–7 days translocation time after application before doing any tillage when conditions are good. If cool temperatures follow application, allow additional time for translocation to be completed before disturbing treated weeds. · Only weeds emerged at application time will be controlled. Additional weed control programs will be necessary to control weeds germinating later. · Repeat application to regrowth may be necessary for complete control. · For specific information on product rates and notes for annual and perennial weed control refer to Table 6–5. Postharvest Weed Control Ratings, page 97. * See Table 4–1. Herbicides Used in Ontario, page 30, for formulations available. See label for specific uses and rates.
	glyphosate (450 g/L)*	0.6–9.6 L/ha (0.24–3.84 L/acre)	
	glyphosate (480 g/L)*	0.56–9 L/ha (0.22–3.6 L/acre)	
	glyphosate (500 g/L)*	0.54–8.64 L/ha (0.22–3.5 L/acre)	
	glyphosate (540 g/L)*	0.67–8 L/ha (0.27–3.2 L/acre)	
clopyralid (0.15–0.3 kg/ha)	LONTREL 360 (360 g/L)	0.42–0.83 L/ha (0.17–0.33 L/acre)	· For control of vetch. · Apply in 150–200 L/ha (60–80 L/acre) water for Christmas trees. · Apply in 150–300 L/ha (60–120 L/acre) water for field grown conifers. · Apply the lower rate for balsam fir Christmas trees. · Apply as a direct foliar application. · For best results, apply LONTREL 360 when vetch stems are 10–15 cm long and before vetch climbs into the tree crown. · Avoid contacting the upper two thirds of the tree crown. · Apply ONCE a year. · **Do NOT** use on seedbeds or transplants.

TABLE 16–2. Herbicide Treatment Rates for Nursery and Ornamental Crops (cont'd)

WOODY NURSERY STOCK – CONTAINER BEDS

CULTURAL WEED CONTROL – A successful weed control program must integrate cultural and chemical weed control practices.

Prepare the container bed area with a gravel layer and/or ground covers such as black plastic or opaque woven material. It is important that these surface covers exclude light in order to be effective in preventing weed seed germination. These ground covers can be used for a number of years before being replaced.

Keep the container beds and roadways free of weeds by physical removal or chemical mowing. Prevent weeds from setting seed in adjacent uncropped areas by using cultural or chemical weed control measures. Mowing at regular intervals will prevent many weeds from flowering. Try to control weed escapes before they set seed by cultural removal or chemical mowing. In some situations, such as along fences, tools such as a weed whip may be useful. Look for the source of weeds that disseminate into container areas such as poplars, willows, willowherb and Canada fleabane.

Control weeds around irrigation ponds so that small seeded weeds are not being sown into container stock with each watering. A vigorous grassed bank will help reduce weed infestations as well as providing bank stabilization. A filtering system in the irrigation line will remove weed seeds.

Removal of existing weeds from container stock before they flower **must be a priority job**. Once a weed flowers it can disseminate hundreds of seeds by wind or by catapulting seeds. Many container weed species have several generations per year because their seeds do not need to overwinter before germinating. Remove and discard all pulled weeds well away from the growing area so that seeds are not disseminated into nearby containers.

Since many species of container weeds overwinter in the protected environment of a polyhouse, it is important to thoroughly weed container stock in the fall. Be sure to remove the rosettes of winter annuals such as shepherd's-purse and Canada fleabane and established plants and seedlings of common and mouse-eared chickweed. If not removed, these plants will be flowering by May or earlier.

WARNING – Refer to manufacturer's instructions for waiting period required after planting.

WARNING – Certain types of woody nursery stock may be injured by the following herbicides. Check manufacturer's directions for labeled species/cultivars before use.

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Soil Applied Grass and Broadleaf Herbicides			
dichlobenil (4.4–7 kg/ha)	CASORON 4G (4 Gr)	110–175 kg/ha (44–70 kg/acre)	• PRE – Apply to bare soil before putting container pots on beds. • Apply in spring when temperatures are cool and incorporate immediately with irrigation or mechanical incorporation. • For the best results, apply to soil with more than 2% organic matter content. • Use on gravel or sandy soils may result in inconsistent weed control. • **Do NOT** cover polyhouses with plastic within 1 month after application. • **Do NOT** apply within plastic covered polyhouses or within greenhouse structures. • Refer to label for tolerant species. • **Do NOT** transplant into treated soil for 1 year.
chlorthal dimethyl (12.75 kg/ha)	DACTHAL W-75 (75 WP)	17 kg/ha (6.8 kg/acre)	• Apply at lining out, late fall or early spring in 340 L/ha (136 L/acre) water. • Applications should be made to soil recently cultivated to a uniform texture. • Rain or Irrigation (1 cm) is needed to activate this herbicide.
napropamide (4.5 kg/ha)	DEVRINOL 2G (2Gr)	225 kg/ha (90 kg/acre)	• Consult the label to determine which plant species are tolerant. • Apply over the container and treat preemergence to the weeds. If weeds are emerged cultivate before application. • Irrigate immediately after application.

TABLE 16–2. Herbicide Treatment Rates for Nursery and Ornamental Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
WOODY NURSERY STOCK – CONTAINER BEDS (cont'd)			
Soil Applied Grass and Broadleaf Herbicides (cont'd)			
pendimethalin (1.68 kg/ha)	PROWL H2O (455 g/L)	3.7 L/ha (1.5 L/acre)	· **Do NOT** apply to newly-transplanted ornamentals and conifers until plants have been watered and soil has been thoroughly packed and settled around roots. · **Do NOT** make over-the-top applications. · **Do NOT** treat plants grown for food or feed. · Rainfall or irrigation is required within 7 days of application. · Unusually cold, excessively wet, or hot and dry conditions that delay weed germination or extend weed germination over a long period of time can reduce weed control. · Avoid unintentional contact of spray solution with stone, wood, or other porous surfaces as staining may occur. Rinse surfaces immediately using a heavy spray of water to avoid staining. · See label for tolerant species.
Grass and Broadleaf Herbicides			
glyphosate (0.27–4.32 kg/ha)	glyphosate (360 g/L)*	0.75–12 L/ha (0.3–4.8 L/acre)	· For actively growing weeds in the fall, or spring prior to emergence of any crop. · Allow 5–7 days translocation time after application before doing any tillage when conditions are good. If cool temperatures follow application, allow additional time for translocation to be completed before disturbing treated weeds. · Only weeds emerged at application time will be controlled. Additional weed control programs will be necessary to control weeds germinating later. · Repeat application to regrowth may be necessary for complete control. · For specific information on product rates and notes for annual and perennial weed control refer to Table 6–3. Specific Notes on Weeds Controlled and Product Rates Associated with Various Glyphonsate Concentrations, page 94. * See Table 4–1. Herbicides Used in Ontario, page 30, for formulations available. See label for specific uses and rates.
	glyphosate (450 g/L)*	0.6–9.6 L/ha (0.24–3.84 L/acre)	
	glyphosate (480 g/L)*	0.56–9 L/ha (0.22–3.6 L/acre)	
	glyphosate (500 g/L)*	0.54–8.64 L/ha (0.22–3.5 L/acre)	
	glyphosate (540 g/L)*	0.5–8 L/ha (0.2–3.2 L/acre)	
Container Grown – Soil Applied Broadleaf Herbicides			
flumioxazin (21–42 kg/ha)	BROADSTAR (0.25%)	84–168 kg/ha (33.6–67.2 kg/acre)	· For preemergent weed control on outdoor container-grown woody ornamentals. · For use on: *Acer ginnala, Acer palmatum, Buxus sempervirens, Juniperus horizontalis, Juniperus Sabina, Picea pungens, Picea glauca, Quercus rubra, Taxus x media, Thuja occidentalis.* · Apply before germination of target weeds or immediately after disturbing the soil surface. · This herbicide can be safely applied over the top of many species of woody ornamental shrubs and trees providing the user follows the label directions. · Apply to dry foliage only. · 1–2 cm of rainfall/irrigation is needed for activation. · **Do NOT** apply more than twice in a single year. · See product label for more information.

TABLE 16–2. Herbicide Treatment Rates for Nursery and Ornamental Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
WOODY NURSERY STOCK – CONTAINER BEDS (cont'd)			
Container Grown – Soil Applied Broadleaf Herbicides (cont'd)			
isoxaben (0.75 kg/ha)	GALLERY (75 DF)	1 kg/ha (0.4 kg/acre)	• **Registered for use by members of the Canadian Forest Nursery Weed Management Association ONLY.** • PRE – for use in bareroot and container conifer seedlings. • Apply prior to weed emergence in conifers, four or more weeks after crop germination and emergence. • Rainfall or irrigation is needed to activate the herbicide. • Apply in 100–400 L/ha (40–160 L/acre) water.
Woody Nursery Stock (Container Grown) – Soil Applied Grass and Broadleaf Herbicides			
dichlobenil (4 kg/ha)	CASORON 4G (4 Gr)	100 kg/ha (40 kg/acre)	• PRE – Apply at least 4 weeks after planting into containers to a weed-free soil surface. • **Do NOT** use after September 15 or within 30 days of covering treated stock in overwintering structures. • Water immediately after application. • Use **ONLY** on containers growing outside. • For use on these species – *Juniperus chinensis, J. horizontalis* and *Thuja occidentalis*.
chlorthal dimethyl (12.75 kg/ha)	DACTHAL W-75 (75 WP)	17 kg/ha (6.8 kg/acre)	• Apply at lining out, late fall or early spring in 340 L (136 L/acre) water. • Applications should be made to soil recently cultivated to a uniform texture. • Rain or Irrigation (1 cm) is needed to activate this herbicide.
napropamide (4.5 kg/ha)	DEVRINOL DF (50 DF)	9 kg/ha (3.6 kg/acre)	• PPI – Apply at any time of the year to a weed-free soil surface. • May be applied to newly planted container stock after the potting media has settled from first watering. • Incorporate by watering within 7 days of a spring or fall application and within 2 days of a summer application. • Will not control bittercress.
	DEVRINOL DF-XT (50 DF-XT)		
	DEVRINOL 10G (10 Gr)	45 kg/ha (18 kg/acre)	
simazine (2.25 kg/ha)	PRINCEP NINE-T (90 WG)	2.5 kg/ha (1 kg/acre)	• PRE – Apply in 300 L/ha (120 L/acre) water. • **For use on juniper, white cedar and yew ONLY.** • Apply **ONLY** once per season, 1 month after planting. • Apply before weeds emerge or after removing weeds from the containers.
oxadiazon (2–4.5 kg/ha)	RONSTAR 2G (2 Gr)	100–225 kg/ha (40–90 kg/acre)	• PRE – Apply any time during the year, prior to weed seed germination. • Can be applied to both newly transplanted and established ornamentals and trees. • **Do NOT** apply to wet foliage or under conditions in which granules will collect on leaves. • If a second application is needed, apply 60–120 days after first application. • Consult the label for list of tolerant species. • Apply at least 4 weeks before covering polyhouses in fall.

TABLE 16–2. Herbicide Treatment Rates for Nursery and Ornamental Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
WOODY NURSERY STOCK – CONTAINER BEDS (cont'd)			
(Container Grown) – Postemergent Grass Herbicides			
fluazifop-p-butyl (0.075–0.25 kg/ha)	VENTURE L (125 g/L)	0.6–2 L/ha (0.24–0.8 L/acre)	• Apply to actively growing grasses prior to tillering. • Apply at 0.6 L/ha (0.24 L/acre) at 2–5 leaf stage of volunteer corn. • Apply at 0.8 L/ha (0.32 L/acre) at 2–5 leaf stage of volunteer wheat and barley. • Apply at 1 L/ha (0.4 L/acre) at 2–5 leaf stage of annual grasses (2–4 leaf for foxtails). • Apply at 2 L/ha (0.8 L/acre) at 3–5 leaf stage of quackgrass and wirestem muhly. • Thorough preplant tillage, fragmenting quackgrass rhizomes, improves control. • **Do NOT** cultivate between rows until 5 days after application. • Consult the label for list of tolerant species. Use as a directed application in sensitive species to avoid contact with leaves and green tissue. Some blue junipers (e.g., Bar Harbour, Blue Acres and Blue Rug) can be injured by over-the-top applications. • **Caution** – There are differences between cultivars in sensitivity. For example – *Juniperus horizontalis* Blue Acres is sensitive while *cv Plumosa Compacta* is tolerant. • Test on samples of each cultivar not specifically listed on the label before using the herbicide or use as a directed application.
DRIVEWAYS, PATIOS AND PATHS			
Postemergent Grass and Broadleaf Herbicides			
acetic acid (33%–40% solution)	ECOCLEAR (25%)	1 L/3–2.25 L of water	• Apply to young, actively growing weeds when temperature is above 15°C. • Complete coverage is necessary to achieve control. • Use the low rate for annual weeds that are small (3–5 leaf). • Use the high rate for larger annual weeds and perennial weeds. • Weeds that are near maturity, flowering, dormant or hardened due to drought or temperature stress are more tolerant to ECOCLEAR treatments and may not be adequately controlled with a single application. • A repeat application is effective for extended control of perennial weeds following initial burn down.
citric acid (19.71 g/L) or lactic acid (17.69 g/L) + surfactant	KONA + surfactant (XA oil concentrate or KORNOIL concentrate or ASSIST oil)	**Broadcast** 25% KONA : 3% surfactant : 72% water or 25 L : 3 L : 72 L **Spot** 50% KONA : 3% surfactant : 47% water or 50 L : 3 L : 47 L	• **Do NOT** apply to newly seeded grasses as severe injury may result. • Application can start in May or later. To provide consistent partial suppression of weeds repeat application every 14 days for at least 5 applications in a season. • Chlorosis to turf may be observed following application, but turf normally recovers in 3 weeks. • **Do NOT** contaminate irrigation or drinking water supplies or aquatic habitats by cleaning of equipment or disposal of wastes. • **Do NOT** apply by air. • Avoid spraying over desirable plants, fruits and vegetables.

TABLE 16–2. Herbicide Treatment Rates for Nursery and Ornamental Crops (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
DRIVEWAYS, PATIOS AND PATHS (cont'd)			
Postemergent Grass and Broadleaf Herbicides (cont'd)			
citric acid (20%)	MUNGER HORTICULTURAL VINEGAR PLUS	1 L of product in 3 L of water	· Best results are achieved from spring and early summer applications to actively growing weeds. · Degree of control depends on several factors, including size and stage of weeds. · Apply on a mostly sunny day with temperatures at or above 21°C (70°F). · Small annual weeds may be completely controlled with a single application. Use 1 L of product in 3 L of water when weeds are small (3–5 leaf) and actively growing. Control of larger, more established weeds, not completely desiccated with 1 application may be short-term and require re-treatment. Use 1 L of product in 2.25 L of water for larger annual weeds and suppression of perennials. · Complete coverage of undesirable vegetation is necessary to achieve control. Only contacted vegetation will be affected. · Rainfall within 1 h of application will reduce degree of control. · Avoid spraying over desirable plants, fruits and vegetables.
SEEDBEDS AND POTTING SOIL			
Soil Applied Fumigants			
dazomet (319–500 kg/ha)	BASAMID (97 Gr)	325–510 kg/ha (130–204 kg/acre)	· **Do NOT** use below 6°C. · Incorporate to a depth of 15–23 cm. · Refer to manufacturer's directions for specific details as well as direction on sealing soil, evacuating gases and performing the safety germination test.
metam sodium (3.8 kg/100 m²)	VAPAM (380 g/L)	10 L/100 m² in 800 L water	· Apply as a drench to a soil that should be wet to a depth of at least 8 cm. · **Do NOT** plant for 10–14 days or longer if the weather is cool. · Cultivate soil 1 week before application. · After cultivating, keep soil moist until application and for 24 h after application.

17. TURFGRASS

NOTES: Weed control ratings are given as 0–9 where 0 indicates no control, and 9 indicates 90%–100% control under ideal conditions. Ratings are subjective values based on best available information and given general comparisons based on use as described in this guide. Under unfavourable conditions (e.g., too dry, too wet, too cold or poor application) the herbicides may not be as effective as indicated. Ratings may vary with weed and crop stage and with the timing and rates of the product(s) being used. Please see product label for more information on registered weed species, product uses and precautions.

TABLE 17–1. Turfgrass Herbicide Weed Control Ratings

LEGEND: Numbers (0–9) = weed control ratings – = insufficient information available to make a rating Refer to product label for list of species controlled.

Trade Name	crabgrass	bentgrass	bluegrass, annual	chickweed, common	black medick	chickweed, mouse-eared	clover, white	dandelion	ground-ivy (creeping-charlie)	knotweed	mallow	nutsedge, yellow	plantains	quack grass
Soil Applied Grass Herbicides														
BETASAN	9	–	3	–	–	–	–	–	–	–	–	–	–	–
DACTHAL W75	8	–	–	8	–	8	–	7	–	–	–	0	0	0
DIMENSION	9	–	–	–	–	–	–	–	–	–	–	–	–	–
Postemergence Grass Herbicides														
ACCLAIM SUPER	9	–	–	–	–	–	–	–	–	–	–	–	–	–
DIMENSION	8	–	–	–	–	–	–	–	–	–	–	–	–	–
Postemergence Broadleaf Herbicides														
2,4-D	–	–	–	3	5	3	3	9	3	4	4	–	9	–
2,4-D/dicamba/mecoprop-P[1]	–	–	–	8	8	8	8	9	6	7	6	–	9	–
BASAGRAN	–	–	–	–	–	–	–	–	–	–	–	8	–	–
FIESTA	–	–	–	7	7	7	7	7	–	–	–	–	7	–
glyphosate[1]	9	9	–	9	–	9	–	8	–	–	–	–	–	9
MCPA AMINE	–	–	–	4	4	3	3	6	3	3	3	–	9	–
MECOPROP, COMPITOX	–	–	–	8	8	8	8	6	7	3	3	–	6	–
mecoprop-P/2,4-D[1]	–	–	–	8	8	7	8	9	2	3	3	–	9	–
KONA	–	–	–	–	6	–	6	–	–	–	–	–	–	–
SARRITOR	–	–	–	–	2	–	7	7	–	3	–	4	7	–
VANQUISH	–	–	–	8	6	8	8	9	8	8	6	–	4	–
Postemergence Grass and Broadleaf Herbicide														
ETHO	6	–	7	6	–	–	–	0	–	–	–	6	–	5
Postemergence Tank-Mixes														
2,4-D + mecoprop-P[1]	–	–	–	8	8	7	8	9	2	3	3	–	9	–

[1] Various formulations available, see Table 4–1. Herbicides Used in Ontario, page 30. Not all formulations are registered on turf. See the label for specific uses and rates.

Ontario's cosmetic pesticides ban took effect April 22, 2009. The requirements of the ban are detailed in Ontario Regulation 63/09 under the *Pesticides Act*. The ban prohibits the sale and use of pesticides for cosmetic purposes such as on lawns, gardens, parks and school yards. There are exceptions to the ban on the use of (Class 9) prohibited pesticides for agriculture and also for golf courses, specialty turf, and specified sports fields, if certain conditions are met.

The following pesticide information include products that contain Class 9 pesticides which can only be used under an exception to the ban. The information in this chapter also include products that contain Class 11 pesticides (biopesticides) and certain lower risk pesticides which are allowed for cosmetic purposes to manage weeds in turfgrass.

To convert kg/ha or L/ha to g/100 m² or mL/100 m² – Multiply by 10 and change units.
For example – 11 kg/ha becomes 110 g/100 m²
28.4 L/ha becomes 284 mL/100 m²

Managing Weeds in Turfgrass

The major species of broadleaf weeds infesting turf in Ontario are dandelion, plantain, black medick, chickweed, prostrate knotweed, mallow, henbit, ground-ivy, and white clover. The major grassy weeds are crabgrass, annual bluegrass, quackgrass, orchard grass and bentgrass.

Cultural Practices to Manage Weeds in Turfgrass

The easiest, cheapest and most effortless way to keep turf fields free of weeds is to encourage vigorous growth of turfgrass. Most weeds cannot compete in a dense, healthy turf. Growth practices that encourage vigorous grass growth discourage weed infestations. Such practices include mowing, fertilizing, watering and drainage, controlling thatch, avoiding compaction, selecting the appropriate turfgrass and removing weeds mechanically.

Mowing stimulates bud development and tillering, inducing the sod to become thick and dense. Cut commonly grown grasses such as the fescues, bluegrasses and turf-type perennial ryegrasses to a height of 4–6 cm. Invasion by weeds may occur if grasses are cut shorter than 4 cm.

Avoid scalping the turf when cutting around trees and flowerbeds. Do not remove more than one-third of the leaf area when mowing. Mowing too frequently may reduce the carbohydrate reserves of the turf, thereby reducing its competitiveness. Mowing can also be used to remove annual weeds and eliminate seed production, reducing or preventing the spread of weeds.

Fertilizer is particularly important in establishing a thick, dense and healthy turf stand. Regular, timely fertilizer applications can help turf out-compete broadleaf and grassy weeds. Too few nutrients applied to the turf leads to increased susceptibility to weed infestation and some disease. Too much fertilizer may lead to soft, weak grass that is also prone to disease and will not stand up to traffic.

Watering is critically important when normal rainfall does not provide enough moisture. Irrigate weekly, using 2.0–2.5 cm of water per application to help produce thick, deep-rooted turf.

Frequent light irrigation will have the opposite effect on the grass roots. It encourages the germination and growth of shallow rooted species such as crabgrass and creeping bentgrass. Too much irrigation water will lead to infestation by yellow nutsedge and annual bluegrass. Provide adequate watering near trees and hedges because they compete for available moisture.

Drainage is important to ensure roots are healthy and functioning. Waterlogged soils do not provide roots with the air they need to function properly. Install adequate drainage if needed.

Compaction should be avoided to prevent invasion of weeds that thrive in compacted soil, such as knotweed and annual bluegrass. Immediate resodding or reseeding of damaged areas will discourage weed infestations. Aeration and reducing excessive traffic will aid in reducing compaction.

Select **turfgrass species** to match the growing environment and the intended use. For example, fescues are tolerant to low-light intensity in shaded areas under trees and also tolerate low maintenance. Turf-type perennial ryegrass varieties are quick to establish in newly seeded areas and will crowd out germinating weeds. Kentucky bluegrass, although slow to establish, is very competitive once established.

Mechanical removal of weeds can be very effective if weed populations are not too high. Weeds can be removed by hand or pulling with a knife or V-shaped spudding tool. There are many new non-selective weed control tools on the market that use steam, hot water, super-heated water and propane flamers. There is limited research on the level of control of these new non-selective weed control tools. It is advisable to try these tools in a small area to determine their effectiveness. Be aware of applicator safety.

Chemical Weed Control

Chemical weed control is often the easiest, most effective and cheapest way to control annual and perennial weeds when populations are very high.

New Turf

After seeding new turf, many annual weeds may emerge before the grass seedlings. If these young weeds are not controlled, they will shade and eventually crowd out much of the grass population. Mowing at a height of 6–8 cm will eliminate many such weeds. If they are extremely thick, 2,4-D at half the usual concentration (0.4–0.6 kg in 800 L water/ha) or mecoprop-P (0.4–0.6 kg in 400 L water/ha) can be used but not before the grass has been emerged for at least 4 weeks.

Established Turf

Applications of 2,4-D are most effective in the spring or in September when the weeds are growing well. This treatment generally thins clover. Weeds not normally controlled by 2,4-D may be controlled by mecoprop, or dicamba, or with combinations of one of these with 2,4-D. Mecoprop and dicamba are also sold in commercial mixtures with 2,4-D. See Table 18–3. *Susceptibility of Woody Plants to Various Herbicides and Mixtures as Foliage Sprays,* page 435 the response of common weeds to various herbicides. Thorough wetting of the weed foliage is important.

Do NOT use mixtures containing dicamba close to shrubs, or other susceptible ornamentals at rates above 0.425 kg/ha (active). Prepared mixtures of this chemical and 2,4-D are effective on a wide range of turf weed species, including knotweed, which is not controlled by most other herbicides except when very young.

Broadleaf Herbicides

2,4-D controls many broadleaf weeds including dandelion, plantains, shepherd's purse, smartweeds and vetch.

Mecoprop controls many 2,4-D and MCPA tolerant weeds such as chickweeds, clovers, ground-ivy and black medick, and is generally safer to use on bentgrass than 2,4-D.

Dicamba controls broadleaf weeds including 2,4-D tolerant weeds such as chickweeds, clover and young knotweed but does not adequately control plantains.

MCPA controls dandelion, plantains and shepherd's purse. Weeds tolerant to MCPA include chickweeds, clovers and black medick. Two and three-way mixes of these herbicides extend the spectrum of weeds that are controlled compared to only one of these herbicides.

Grass Herbicides

BETASAN, DIMENSION and corn gluten meal based products can be applied before crabgrass emerges in the spring, and ACCLAIM SUPER and DIMENSION can be applied after emergence. Corn gluten meal based products can also be applied in the fall.

Herbicide Application Timings

Site Preparation or Preplant (PP) Treatments

Preplant treatments are applied before the turf is sown or planted. Also see Table 6–4, *Herbicide Treatment Rates for Preplant Weed Control,* page 95 for details of products, rates and remarks.

Preemergence (PRE)

Rainfall at 15–20 mm within 7–10 days after application is necessary to activate preemergence treatments. These materials prevent emergence of many weed seedlings without reducing turf stand. Apply immediately after seeding or at least before the emergence of the turf.

Postemergence (POST)

Herbicides are applied after the turf seeds have sprouted. Applied as directed, the weeds can be killed without injury to the turf. It is important to apply herbicides to weeds at their most susceptible stage. Smaller weeds are generally easier to kill but enough leaf surface is needed to intercept the required amount of herbicide.

TABLE 17–2. Herbicide Treatment Rates for Turfgrass

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Preplant Herbicide			
Apply in 200–300 L/ha (80–120 L/acre) water.			
glyphosate (0.27–4.32 kg/ha)	glyphosate (360 g/L)*	0.75–12 L/ha (0.3–4.8 L/acre)	· Glyphosate is a **non-selective herbicide that will kill turf that is sprayed**. · For actively growing weeds in the fall or spring prior to planting (otherwise turf will be killed). · Allow 5–7 days translocation time after application before doing any tillage when conditions are good. If cool temperatures follow application, allow additional time for translocation to be completed before disturbing treated weeds. · Only weeds emerged at application time will be controlled. Additional weed control programs will be necessary to control weeds germinating later. · Repeat application to regrowth may be necessary for complete control. · For specific information on product rate and notes for annual and perennial weed control, refer to Table 6–3. Specific Notes on Weeds Controlled and Product Rates Associated with Various Glyphosate Concentrations, page 94. * See Table 4–1. Herbicides Used in Ontario, page 30, for formulations available. Not all formulations are registered on turf. See label for specific uses and rates.
	glyphosate (480 g/L)*	0.56–9 L/ha (0.22–3.6 L/acre)	
	glyphosate (500 g/L)*	0.54–8.64 L/ha (0.22–3.5 L/acre)	
	glyphosate (540 g/L)*	0.67–8 L/ha (0.27–3.2 L/acre)	
Preemergence Grass Herbicides			
Apply in 800–1,000 L/ha (320–400 L/acre) water, unless otherwise stated.			
bensulide (11–14.4 kg/ha)	BETASAN (480 g/L)	23–30 L/ha (9.2–12 L/acre)	· PRE – Apply to established turf before crabgrass emergence in early spring or in fall. · Use the low rate for crabgrass and the high rate for annual bluegrass. · **Do NOT** reseed the area for 1 year following treatment. · **Do NOT** apply peatmoss to turf before application. · **Use ONLY on mineral soils.**
	BETASAN (GR) (12.5 Gr)	125 kg/ha (50 kg/acre)	
chlorthal dimethyl (11.625 kg/ha)	DACTHAL W-75 (75 WP)	15.5 kg/ha (6.2 kg/acre)	· PRE – Apply early in spring before weed seed germination. · Apply in 450–1,100 L/ha (180–440 L/acre) water. · **Do NOT** apply to Cohansey and Toronto bentgrass. · **Do NOT** re-seed for 60 days after application.
dithiopyr (0.42 kg/ha)	DIMENSION (124 g/L)	3.5 L/ha (1.4 L/acre)	· PRE – Apply in established turf before crabgrass emergence. · See POST application below. · Apply in 200–800 L/ha (80–320 L/acre) water. · Allow turf to recover from aeration or other stresses before application. · **Do NOT** apply to putting greens during the first year of establishment. · Check the label for sensitive varieties, including Colonial bentgrasses. · **Do NOT** irrigate within 2 hours of application. · **Do NOT** reseed for 3 months after application. · May be tank-mixed with KILLEX or other broadleaf herbicides. · **Do NOT** tank-mix with other products for application to putting greens.

TABLE 17–2. Herbicide Treatment Rates for Turfgrass (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Inhibitors of Smooth Crabgrass and Dandelion Seed Germination			
corn gluten meal	NUTRITE PRE-EMERGENT, CRABGRASS WEED SEED GERMINATION INHIBITOR (100% corn gluten meal)	980 kg/ha (392 kg/acre) **or** 9.8 kg/100 m^2 (20 lb/1,000 ft^2)	· The product may inhibit dandelion, white clover and smooth crabgrass weed seed germination when used in conjunction with a sound turf maintenance program. · This product will not control emerged or established dandelion, white clover or smooth crabgrass. · PRE – Apply to established turf twice each year; once in early spring and once in late summer or early fall to sports fields, parks, golf areas and sod farms. · Apply using a rotary or small hand spreader. · Spring application: apply two weeks before large crabgrass seed germination. · Late summer or early fall: apply after heat stress has passed. · Apply to a mature turf where established perennial ryegrass or established Kentucky bluegrass is the predominant species. · **Do NOT** apply on newly seeded grass, wait until after first mowing. · **Do NOT** apply under windy conditions. · **Do NOT** apply in the spring if overseeding or resodding in the spring. · **Do NOT** apply in the fall if overseeding or resodding in the fall. · **Do NOT** apply if allergic to corn.
corn gluten meal	TURFMAIZE PRE-EMERGENT WEED SEED GERMINATION INHIBITOR (98% corn gluten meal)	970 kg/ha (388 kg/acre) **or** 9.7 kg/100 m^2 (20 lb/1,000 ft^2)	· This product may inhibit dandelion and smooth crabgrass weed seed germination when used in conjunction with a sound turf maintenance program. · This product will not control emerged or established dandelion or smooth crabgrass. · PRE – Apply to Kentucky bluegrass turf twice a year: once in the early spring and once in the late summer/early fall. · Apply using a rotary or small hand spreader. · Spring application: apply to established Kentucky bluegrass turf in early spring before smooth crabgrass and dandelion seed germination. · Late summer/early fall: apply to established Kentucky bluegrass turf in late summer or early fall after heat stress has passed. · Apply when soil is moist and rain is forecasted within 2 days of treatment. · If rainfall does not occur within 2 days of treatment, irrigation is required. · Excessive moisture at time of treatment may reduce the effectiveness. · **Do NOT** apply on newly seeded grass, wait until after first mowing. · **Do NOT** apply in the spring if overseeding or resodding in the spring. · **Do NOT** apply in the fall if overseeding or resodding in the fall. · **Do NOT** apply if allergic to corn.

TABLE 17–2. Herbicide Treatment Rates for Turfgrass (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Soil Applied Broadleaf Herbicides			
mesotrione (0.144 kg/ha)	CALLISTO 480SC (480 g/L)	0.30 L/ha (0.12 L/acre)	· Apply CALLISTO pre-emergence to weeds in established sod OR prior to, or post-seeding and prior to emergence of weeds. Cool-season turf species and varieties may vary in their tolerance to herbicides, including CALLISTO. Since not all cool-season turf varieties have been tested for tolerance to CALLISTO, first use should be limited to a small area of each variety or mixture to confirm tolerance prior to adoption as a general field practice. Additionally, consult your seed supplier for information on the tolerance of specific cool-season turf varieties to CALLISTO. **Do NOT** apply to creeping bentgrass. · Apply in 250 L/ha (100 L/acre) water. · Make application close to anticipated weed seed germination. Apply at grass seeding for best performance. Weed control is most effective on young actively growing weeds. Avoid spraying on newly germinated turfgrass plants. Efficacy will be reduced under moisture stress or from applications to mature weeds. · CALLISTO may reduce density of fine fescue seedlings. CALLISTO can be used on grass blends that contain less than 20% by weight of hard or fine fescue. · Apply by ground boom equipment. · **Do NOT** apply by hand. · **Do NOT** apply through irrigation equipment.
Soil Applied Grass and Broadleaf Herbicides			
ethofumesate (1.1 kg/ha)	ETHO SC (480 g/L)	2.3 L/ha (0.9 L/acre)	· Apply PRE prior to seeding. · A second application at 6 weeks after planting may be required for control of annual bluegrass. · Efficacy is reduced as the organic matter content increases and on fine textured soil. · Test ETHO SC on small areas for each turf species for tolerance prior to use on whole field. · Apply with 110–560 L/ha (44–224 L/acre) water.

TABLE 17–2. Herbicide Treatment Rates for Turfgrass (cont'd)

ACTIVE INGREDIENT (rate)	**TRADE NAME (Concentration)**	**PRODUCT RATE**	**PRECAUTIONS** For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Postemergence Grass Herbicides			
Apply in 400–800 L/ha (160–320 L/acre) water.			
fenoxaprop-p-ethyl (0.092 kg/ha)	ACCLAIM SUPER EC (80.5 g/L)	1.14 L/ha (0.46 L/acre)	• POST – For the control of crabgrass at the 1–4 leaf up to the multi-tiller stage. • Good coverage is essential to control multi-tillered or grassy weeds in the reproductive phase. • Make a second application on mature monostands 21 days after first application. • **Do NOT** apply to bentgrass or seedling Kentucky bluegrass. • **Do NOT** tank-mix with any other herbicide or pesticide. • **Do NOT** apply broadleaf herbicides 7 days before or after ACCLAIM SUPER. • **Do NOT** apply during periods of drought stress. • **Do NOT** mow grass for 4 days before or after application. • **Do NOT** irrigate within 3 h after application.
dithiopyr (0.43–0.56 kg/ha)	DIMENSION (124 g/L)	3.5–4.5 L/ha (1.4–1.8 L/acre)	• POST – For established turf until crabgrass reaches the 1–3 leaf stage before tillering; **Do NOT** apply after the 3 leaf stage. See PRE application above. • Use the higher rate for larger plants or when area is heavily infested. • Apply in 200–800 L/ha (80–320 L/acre) water. • Allow turf to recover from aeration, or other stresses before application. • **Do NOT** apply to putting greens during the first year of establishment. • Check the label for sensitive varieties, including Colonial bentgrass. • **Do NOT** irrigate within 2 h of application. • **Do NOT** reseed for 3 months after application. • May be tank-mixed with KILLEX or other broadleaf herbicides **EXCEPT** for application to putting greens.
Postemergence Broadleaf Herbicides			
Apply in 200–400 L/ha (80–160 L/acre) water. Avoid contact with ornamentals and flowers. Avoid applying during hot, dry weather. **Do NOT** irrigate, rake, and/or mow until at least 24 hours after application. **Do NOT** apply to newly seeded turf until after second mowing.			
2,4-D (0.8–1.5 kg/ha)	2,4-D (470 g/L)*	2.25 L/ha (0.9 L/acre)	• To control many broadleaf weeds including dandelion, lamb's-quarters, mustards, peppergrass, pigweeds, plantains, shepherd's-purse, smartweeds, and vetch. • Damage may occur when applied to bentgrass. • If used on bentgrass apply at 0.28 kg ai/ha. Some yellowing of bentgrass may occur. * See Table 4–1. Herbicides Used in Ontario, page 30, for formulations available. Not all formulations are registered on turf. See label for specific uses and rates.
	2,4-D (564 g/L)*	2.7 L/ha (1.08–1 L/acre)	
	2,4-D (660 g/L)*	1.28–2.35 L/ha (0.51–0.94 L/acre)	
2,4-D/ dicamba/ mecoprop-P (1.7 kg/ha)	2,4-D/dicamba/mecoprop-P (308 g/L)*	5.5 L/ha (2.2 L/acre)	• To control 2,4-D and MCPA tolerant weeds such as chickweeds, clovers, ground-ivy and black medick as well as many broadleaf weeds including dandelion, lamb's-quarters, mustards, peppergrass, pigweeds, plantains, shepherd's-purse, smartweeds, and vetch. • In closely mowed bentgrass (greens) apply at half doses (30 mL/100 m²). • Temporary yellowing of bentgrass may occur. • Recovery from injury will occur 1 week after application. • See precautions for VANQUISH, page 418. * See Table 4–1. Herbicides Used in Ontario, page 30, for formulations available. Not all formulations are registered on turf. See label for specific uses and rates.

TABLE 17–2. Herbicide Treatment Rates for Turfgrass (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Postemergence Broadleaf Herbicides (cont'd)			
2,4-D (0.85–1.1 kg/ha) + mecoprop-P (0.85–1.1 kg/ha)	2,4-D (470 g/L)* + MECOPROP (150 g/L)	1.81–2.34 L/ha (0.72–0.93 L/acre) + 5.67–7.34 L/ha (2.27–2.93 L/acre)	· May be combined with VANQUISH (0.21 L/ha (0.08 L/acre) for control of young knotweed. · Damage may occur when applied to bentgrass. · For newly established turf at least 4 weeks old, use 2,4-D at half the usual concentration (0.4–0.6 kg in 800 L/ha or 0.16–0.24 kg in 320 L/acre water) or mecoprop-P (0.4–0.6 kg in 400 L/ha (0.16–0.24 kg in 160 L/acre water) for annual weeds.
	2,4-D (564 g/L)* + MECOPROP (150 g/L)	1.51–1.95 L/ha (0.6–0.78 L/acre) + 5.67–7.34 L/ha (2.27–2.93 L/acre)	
	2,4-D (660 g/L)* + MECOPROP (150 g/L)	1.29–1.67 L/ha (0.52–0.67 L/acre) + 5.67–7.34 L/ha (2.27–2.93 L/acre)	* See Table 4–1. Herbicides Used in Ontario, page 30, for formulations available. Not all formulations are registered on turf. See label for specific uses and rates.
bentazon (0.84 kg/ha) + oil concentrate (2 L/ha)	BASAGRAN (480 g/L) + ASSIST	1.75 L/ha (0.7 L/acre) + 2 L/ha (0.8 L/acre)	· **Do NOT** mow grass 3–5 days before and after application. · **Do NOT** treat newly seeded turf until well established. · **Do NOT** apply more than two applications per year. · To control top growth of yellow nutsedge. Apply when nutsedge is young and actively growing. If needed, make 2 applications 10–14 days apart.
mesotrione (0.1 kg/ha) + non-ionic surfactant (0.2% v/v)	CALLISTO 480SC (480 g/L) + AGRAL 90	0.21 L/ha (0.084 L/acre) + 2 L/1,000 L	· Wait until newly germinated turf has been mowed twice or 4 weeks after emergence (whichever is longer) before making a post emergence application. · Apply by ground boom equipment. · Apply in 250 L/ha (100 L/acre) water. · **Do NOT** apply by hand. · **Do NOT** apply through irrigation equipment.
mecoprop-P (0.83–1.28 kg/ha)	COMPITOX (150 g/L)	5.5–8.5 L/ha (2.2–3.4 L/acre)	· To control 2,4-D and MCPA tolerant weeds such as chickweeds, clovers, ground-ivy and black medick, as well as many broadleaf weeds. · May be applied to bentgrass. · Apply to dandelion prior to flowering. · Repeated applications may be needed for dandelion and black medick.
	MECOPROP (150 g/L)		
iron (FeHEDTA) (4.43%)	FIESTA (4.43%)	0.04 L/0.96 L of water **or** 1 L/24 L of water 1 L of product will treat 62.5–125 m^2 (672.5–1345 ft^2)	· Apply the mixed solution at a rate of 200–400 mL/m^2. Use the lower rate (200 mL/m^2) on small weeds and the higher rate (400 mL/m^2) on larger weeds. · Uniform coverage is important on tough perennial weeds such as clover. · Repeat treatment **ONCE** in 4 or more weeks after the first treatment if necessary. · **Do NOT** apply to drought stressed grass. Ensure lawn is well watered prior to application. · **Do NOT** apply when daytime temperatures exceed 30°C. · **Do NOT** apply to bentgrass. · Apply to established turf **ONLY**. Do not apply to newly seeded areas or to turf seeded that is less than 1 year old. · **Do NOT** apply if rainfall is expected within 3 h of application. **Do NOT** irrigate within 3 hours of application. · **Do NOT** apply more than 2 times per year.

TABLE 17–2. Herbicide Treatment Rates for Turfgrass (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Postemergence Broadleaf Herbicides (cont'd)			
mecoprop-P/2,4-D (2 kg/ha)	IPCO PREMIUM 2-WAY XP TURF HERBICIDE ((1:1) 400 g/L)	5 L/ha (2 L/ha)	• May be combined with VANQUISH (0.21 L/ha (0.08 L/acre)) for control of young knotweed. • Damage may occur when applied to bentgrass. • For newly established turf at least 4 weeks old, use 2,4-D at half the usual concentration (0.4–0.6 kg in 800 L/ha or 0.16–0.24 in 160 L/acre water) or mecoprop-P (0.4–0.6 kg in 400 L/ha or 0.16–0.24 in 160 L/acre water for annual weeds. • **Do NOT** apply more than two applications per year.
MCPA (0.5–1.25 kg/ha)	MCPA AMINE (500 g/L)*	1–2.5 L/ha (0.04–1 L/acre)	• For control of field horsetail, dandelion, lamb's-quarters, mustards, plantains, shepherd's-purse, and wild carrot. • **Do NOT** apply to bentgrass unless necessary, and then only at 0.28 kg/ha (0.11 kg/acre). Some yellowing of bentgrass may occur. • **Do NOT** apply more than two applications per year. • Reduced control of dandelion and plantain may occur during dry, hot weather. * See Table 4–1. Herbicides Used in Ontario, page 30, for formulations available. Not all formulations are registered on turf. See label for specific uses and rates.
mecoprop-P/2,4-D (1.7–2.2 kg/ha)	MECOTURF PLUS 2,4-D ((1:1) 400 g/L)	4.25–5.5 L/ha (1.7–2.2 L/acre)	• May be combined with VANQUISH (0.21 L/ha (0.08 L/acre)) for control of young knotweed. • Damage may occur when applied to bentgrass. • For newly established turf at least 4 weeks old, use 2,4-D at half the usual concentration (0.4–0.6 kg in 800 L/ha or 0.16–0.24 in 320 L/acre water) or mecoprop-P (0.4–0.6 kg in 400 L/ha or 0.16–0.24 in 160 L/acre water) for annual weeds.
citric acid (20%)	MUNGER HORTICULTURAL VINEGAR PLUS	1 L of product in 3 L of water	• Best results are achieved from spring and early summer applications to actively growing weeds. • Degree of control depends on several factors, including weed size and stage at time of application. • Apply on a mostly sunny day with temperatures at or above 21°C (70°F). • Small annual weeds may be completely controlled with a single application. Use 1 L of product in 3 L of water to apply when weeds are small (3–5 leaf) and actively growing. Control of larger, more established weeds, not completely desiccated with 1 application may be short-term and require re-treatment. Use 1 L of product in 2.25 L of water for larger annual weeds and suppression of perennials. • Complete coverage of undesireable vegetation is necessary to achieve control. Only contacted vegetation will be affected. • Rainfall within 1 h of application will reduce degree of control. • Avoid spraying over desireable plants, fruits and vegetables.

TABLE 17–2. Herbicide Treatment Rates for Turfgrass (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (Concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
Postemergence Broadleaf Herbicides (cont'd)			
citric acid (19.71 g/L) + lactic acid (17.69 g/L) + surfactant	KONA + surfactant (XA oil concentrate **or** KORNOIL concentrate **or** ASSIST oil)	Broadcast 25% KONA : 3% surfactant : 72% water or 25 L : 3 L : 72 L Spot 50% KONA : 3% surfactant : 47% water or 50 L : 3 L : 47 L	· **Do NOT** apply to newly seeded grasses as severe injury may result. · Application can start in May or later. To provide consistent partial suppression of weeds repeat application every 14 days for at least 5 applications in a season. · Chlorosis to turf may be observed following application, but turf normally recovers in 3 weeks. · **Do NOT** contaminate irrigation or drinking water supplies or aquatic habitats by cleaning of equipment or disposal of wastes. · **Do NOT** apply by air. · Avoid spraying over desirable plants, fruits and vegetables.
Sclerotinia minor (strain IMI 344141)	SARRITOR	40–60 g/m²	· For suppression of dandelion and other broadleaf weeds. · Apply when daytime high temperatures are 18–24°C and rainfall occurs within 12 h of application. · Use higher rate when environmental conditions are sub-optimal or when dandelion pressure is high. · **Do NOT** mow for 3 days after application. · **Do NOT** allow contact with non-target, desirable plant species as severe damage may occur.
dicamba (0.13–0.6 kg/ha)	VANQUISH (480 g/L)	0.28–1.25 L/ha (0.11–0.50 L/acre)	· **Do NOT** apply to bentgrass. · **Do NOT** apply near shallow rooted perennials to avoid root uptake and injury. · To control broadleaf weeds including 2,4-D tolerant weeds such as chickweeds, clover and young knotweed, but will not adequately control plantain. · Prepared mixtures of VANQUISH and 2,4-D are effective on a wide range of turf weed species, including knotweed, which is not controlled by most other herbicides except when very young. · **Do NOT** use mixtures containing VANQUISH close to shrubs, or other susceptible ornamentals, at rates above 0.425 kg/ha (active). · **Do NOT** mow grass 1 day after application.
	VMD 480 (480 g/L)		
Renovation			
Mow and thoroughly rake the turf to be renovated to remove all dead and cut vegetation.			
glyphosate (0.86–4.3 kg/ha)	glyphosate (360 g/L)*	2.5–12 L/ha (1–4.8 L/acre)	· Apply in 100–300 L/ha (40–120 L/acre) water after omitting at least 1 regular mowing. · Ideally delay tillage 7 days after application to allow for proper translocation into underground plant parts. · Direct seeding into the killed turf (no tillage) may be carried out. * See Table 4–1. Herbicides Used in Ontario, page 30, for formulations available. Not all formulations are registered on turf. See label for specific uses and rates.
	glyphosate (480 g/L)*	1.8–9 L/ha (0.72–3.6 L/acre)	
	glyphosate (500 g/L)*	3.4–5 L/ha (1.36–2 L/acre)	
	glyphosate (540 g/L)*	1.67–8 L/ha (0.67–3.2 L/acre)	

18. ROADSIDES & NON-CROP AREAS

Roadsides, Rights-of-Way, Fencerows and Non-Crop Areas

Fencerows and Farm Areas

In agricultural areas, weeds growing in fencerows, around buildings and on roadsides are sources of potential weed infestation to other parts of a farm. In addition, brush and weeds around fields harbor insects, diseases and other pests that may be detrimental to farming operations. Shrubs like wild cherry may be possible sources of livestock poisoning. Farmers may also wish to reclaim land on which willows or brush have encroached.

Ontario's cosmetic pesticides ban came into effect April 22, 2009. The requirements of the ban are detailed in Ontario Regulation 63/09 under the *Pesticides Act*. Use of Class 9 pesticides for agricultural purposes is exempt from the cosmetic pesticides ban. Farmers are not exempt from the cosmetic pesticides ban when using pesticides for maintaining lawns and gardens around the farm house. Lawns and gardens are not considered part of an agricultural operation.

Roadsides, Rights-of-Way and Waste Places

Under exceptions to the cosmetic pesticides ban, Class 9 pesticides can be used in situations related to the promotion of public health or safety. Ontario Reg. 63/09 defines "the promotion of public safety or health" to include "the destruction, prevention, or control of plants, fungi or animals that affect public works or other buildings and structures." Public work is defined in the regulation, and means a structure that provides a benefit to the public and that is owned or operated by the Government of Ontario or Canada or by any board or commission thereof, or by any municipal corporation, public utility commission or by private enterprise and includes:

- Any railway, canal, highway, bridge, power works including all property used for the generation, transformation, transmission, distribution or supply of hydraulic or electrical power, gas works, water works, public utility or other work.

Class 9 pesticides can be used in an extermination related to public works only for the following:

- To prevent structural damage to a public work, if the potential damage to the public work caused by the pest would place the health or safety of a person at risk.
- For essential maintenance of the public work, if the pest would interfere with or prevent the essential maintenance.
- To allow for emergency access to the public work.
- To ensure the security of the public work if the pest would place the security at risk (eg., vegetation-free security perimeters at power generating facilities).
- To prevent damage to the structural integrity of a building or other structure that is not part of a public work, if the potential damage caused to the building or structure by the pest could place the health or safety of a person at risk.

The use of pesticides for the above mentioned applications does not include the use of Class 9 pesticides along portions of highways that are accessed by pedestrians on a regular basis or other portions where the public is invited to stop, including a rest area or picnic area.

Commencing April 22, 2010, Class 9 pesticides used for extermination with respect to a public work must be applied by an appropriately licensed exterminator who is certified by the Integrated Pest Managment Council of Canada (IPMCC) as a Public Works IPM Certified Applicator or licensed exterminator working under written instructions of a person who is a Public Works IPM Certified Applicator certified by the IPMCC body. The owner or operator of the public work is responsible for ensuring an annual report is prepared that summarizes all pesticides used.

Integrated Weed Management (IWM) on rights-of-way (ROW) and roadsides is based on the principles discussed in Section 1 Principles of Integrated Weed Management. IWM in public work situations involves managing weeds and brush by encouraging compatible vegetation by using a mixture of all tools available, such as competitive or allelopathic vegetation cover, mechanical and chemical weed control, biological weed control, and cultural methods. Compatible vegetation that competitively reduces weed and brush invasion is planted or allowed to develop naturally through selective and targeted herbicide applications (such as directed foliar, basal bark and cut-surface applications) or other weed control methods. Zonal management allows for reduced control measures on parts of a ROW based on the safety limitations. Pre and post control monitoring of problem vegetation and compatible vegetation goals permits the matching of treatments to the problem weeds or brush and the adjustment of programs to improve effectiveness. Effective programs incorporating targeted herbicide applications and both post-emergent and residual products extend the time periods between treatments based on individual ROW requirements.

Both railway and power supply authorities are concerned with maintaining safe and accessible rights-of-way by controlling growth of weeds and brush. In certain areas (beneath guide rails, in storage yards, under railway tracks and under fences at road intersections), it may be advantageous to completely kill all vegetation for long-term control. Consider vegetation control measures such as mechanical (e.g., cutting or mowing) and cultural practices (e.g., seeding desirable species) as an alternative to herbicides.

Precautions should always be taken to minimize herbicide drift in roadside and right-of-way vegetation management. It is advisable to inspect or monitor each roadside just prior to spraying to locate susceptible crops, water crossings, portions of highways that are accessed by pedestrians on a regular basis or other portions where the public is invited to stop, and other sensitive areas. Appropriate "shut off" and "turn on" points should be marked so these areas can be avoided during the actual spray operation.

Reduction of Herbicidal Drift

In the application of herbicides, especially of the hormone type (2,4-D, mecoprop, dichlorprop, dicamba, etc.) sensitive crops (grapes, tomatoes, turnips, tobacco, beans, carrots, beets, fruit trees, ornamental plants and many others) beyond the area being sprayed can be damaged by vapor or spray drift.

To reduce the danger of herbicidal drift:

1. Use only amine formulations when it is necessary to apply phenoxy herbicides (2,4-D, mecoprop, dichlorprop, etc.) near sensitive, non-target plants.

2. Very slight spray drift with herbicides containing dicamba can be more damaging to soybeans and other crops than equivalent amounts of 2,4-D spray drift. There is also a possibility of dicamba vapor drift from treated plant foliage during high temperatures (in excess of 25°C); thus, use of dicamba containing herbicides should be avoided near sensitive, desirable plants.

3. Use the lowest pressure possible to apply the herbicide. This may mean the use of a dribble bar, Radiarc® boom, vibrajet nozzle, Directa-spra™ nozzle, flood jet or more conventional nozzle tips.

4. Manufacturer's recommendations regarding nozzle spacing and height should be carefully followed. It may be necessary to mount nozzles on skids to keep them at a constant distance from the surface to be sprayed.

5. For roadside spraying various spray additives are available which may reduce spray drift by increasing the viscosity or density of the spray. These materials should be used following manufacturer's directions and observing normal precautions (vehicle speed, wind velocity, proximity to sensitive crops, etc.).

WARNING – These methods and materials can reduce but not eliminate herbicidal drift. In areas near sensitive crops, all normal precautions must be taken. It should be emphasized that extremely low, even invisible, amounts of spray drift can be very damaging to sensitive crops.

TABLE 18–1. Susceptibility of Various Weeds to Non-Crop Land Herbicides

LEGEND: ✓ = noxious weed x = not noxious C = Controlled, S = Suppressed, TG = Top Growth, NC = Not Controlled
* = weed is listed on the product label for control or suppression – = insufficient information available to make a rating

Weeds	**Noxious[1]**	**2,4-D ESTER (660 g/L)[2]**	**ARSENAL POWERLINE**	**CASORON**	**CLEARVIEW**	**DIUREX/KARMEX**	**dichlorprop/2,4-D (610 g/L)[2]**	**ESCORT**	**FIESTA**	**GARLON XRT**	**glyphosate (360 g/L)[2]**	**HYVAR X-L**	**MILESTONE**	**MUNGER HORT. VINEGAR PLUS**	**NAVIUS**	**PAYLOAD**	**TELAR**	**TORDON 101**	**TRUVIST**	**LONTREL 360**	**VANQUISH**
bedstraw, smooth (rate/ha)	✓	–	–	–	C (170 g)	–	–	–	–	C* (2.5 L)	C (2% v/v)	–	C (0.5 L)	–	–	–	–	–	C* (168 g)	–	–
bindweed, field (rate/ha)	x	S* (1.28 L)	C* (3 L)	C* (175 kg)	–	–	–	–	–	C* (2.5 L)	C* (2% v/v)	–	–	–	C* (167 g)	–	–	–	–	–	C* (2.3 L)
burdock, common (rate/ha)	x	TG* (1.28 L)	C* (3 L)	–	–	–	C* (2.75 L)	–	–	C* (2.5 L)	C* (2% v/v)	–	–	–	–	–	–	C* (7 L)	–	–	–
buttercup (rate/ha)	x	TG (1.28 L)	–	–	C* (135 kg)	–	C* (2.75 L)	–	C* (4.2% v/v)	–	–	–	C* (0.29 L)	–	–	–	–	–	C* (168 g)	–	–
bluebur (rate/ha)	x	C* (1.28L)	–	–	C* (135 kg)	–	–	–	–	–	–	–	–	–	–	–	–	–	C* (168 g)	–	–
carrot, wild (rate/ha)	x	–	C* (3 L)	–	C (230 g)	–	–	–	–	–	C (2% v/v)	C* (45 L)	–	S* (45% v/v)	C* (167 g)	–	C* (70 g)	C* (7 L)	–	–	–
chervil, wild (rate/ha)	✓	–	S* (3 L)	–	C (170 kg)	–	S* (2.75 L)	–	–	–	C (2% v/v)	–	–	–	–	–	–	–	C* (168 g)	–	–
chamomile, scentless (rate/ha)	x	–	–	–	C* (135 kg)	–	–	C* (20 g)	–	–	C* (2% v/v)	–	C* (0.38 L)	–	C* (167 g)	–	C* (30 g)	–	C* (168 g)	C* (0.56 L)	C* (1.25 L)
chicory (rate/ha)	x	TG* (1.28 L)	–	–	NC	–	C* (2.75 L)	–	–	C* (2.5 L)	–	–	–	–	–	–	–	–	–	–	–
cinquefoil, sulphur (rate/ha)	x	–	C* (3 L)	–	–	–	C* (2.75 L)	–	–	–	–	–	–	–	–	–	–	–	–	–	C* (9.2 L)
cocklebur (rate/ha)	x	C* (1.28 L)	–	–	–	S	C* (2.75 L)	–	–	–	C* (1% v/v)	–	–	–	–	–	–	–	–	–	–
colt's foot (rate/ha)	✓	–	–	–	–	–	–	–	–	–	C (2% v/v)	–	–	–	–	–	–	–	–	–	–

[1] Noxious Weed as listed under the *Weed Control Act*, R.S.O. 1990, Chapter W.5.
[2] Numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, page 30.
[3] Controls narrow leaved plantain and suppresses broad-leaved plantain.
[4] Must be tank-mixed with 2,4-D to achieve this level of control.

TABLE 18–1. Susceptibility of Various Weeds to Non-Crop Land Herbicides (cont'd)

LEGEND: ✓ = noxious weed x = not noxious C = Controlled, S = Suppressed, TG = Top Growth, NC = Not Controlled
* = weed is listed on the product label for control or suppression – = insufficient information available to make a rating

Weeds	Noxious[1]	2,4-D ESTER (660 g/L)[2]	ARSENAL	CASORON	CLEARVIEW	DIUREX/KARMEX	dichlorprop/2,4-D (610 g/L)[2]	ESCORT	FIESTA	GARLON XRT	glyphosate (360 g/L)[2]	HYVAR X-L	MILESTONE	MUNGER HORT. VINEGAR PLUS	NAVIUS	PAYLOAD	TELAR	TORDON 101	TRUVIST	LONTREL 360	VANQUISH
clover, alsike (rate/ha)	x	–	C* (3 L)	–	–	–	–	–	–	–	–	–	–	S* (45% v/v)	–	–	–	–	–	C* (0.42 L)	–
clover, sweet (rate/ha)	x	C* (1.28 L)	C* (3 L)	–	C* (135 g)	–	C* (2.75 L)	C* (20 g)	–	–	–	–	–	S* (45% v/v)	C* (167 g)	–	C* (15 g)	C* (7 L)	C* (168 g)	–	–
cudweed (rate/ha)	x	–	–	–	–	–	–	–	–	–	–	–	C* (0.38 L)	–	–	–	–	–	–	–	–
daisy, ox-eye (rate/ha)	x	–	C* (3 L)	–	C* (135 g)	–	–	–	–	–	–	–	C* (0.29 L)	–	C* (167 g)	–	–	–	C* (168 g)	C* (0.56 L)	–
dandelion (rate/ha)	x	S* (1.28 L)	C* (3 L)	–	C* (135 g)	C* (11.25 kg)	C* (2.75 L)	C* (25 g)	C* (4.2% v/v)	C* (2.5 L)	C (2% v/v)	C* (45 L)	–	S* (45% v/v)	C* (167 g)	C* (0.42 kg)	S* (70 g)	C* (3.7 L)	C* (168 g)	–	–
dock spp. (rate/ha)	x	TG* (1.28 L)	–	–	C* (135 g)	–	–	–	–	C* (2.5 L)	C (2% v/v)	–	C* (0.38 L)	S* (45% v/v)	–	–	–	C* (7 L)	–	–	–
dogbane (rate/ha)	x	–	–	–	–	–	C* (2.75 L)	–	–	–	C (2% v/v)	–	–	–	–	–	–	–	–	–	–
dog strangling vine (rate/ha)	✓	–	C* (3 L)	–	–	–	–	–	–	–	S (2% v/v)	–	–	–	–	–	–	–	C* (168 g)	–	–
fern, bracken (rate/ha)	x	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	C* (9.2 L)
fleabane spp. (rate/ha)	x	C* (1.28 L)	–	–	C* (135 g)	–	–	–	–	–	C* (2% v/v)	–	C* (0.29 L)	S* (45% v/v)	–	–	–	C* (7 L)	C* (168 g)	–	–
goat's beard (rate/ha)	x	C* (1.28 L)	C* (3 L)	–	C* (135 g)	–	C* (2.75 L)	–	–	–	–	–	–	–	–	–	–	–	–	–	C* (4.6 L)
goldenrod (rate/ha)	x	–	C* (3 L)	–	S* (135 g)	C* (11.25 kg)	C* (2.75 L)	–	–	–	–	–	–	–	–	–	S* (70 g)	C* (7 L)	C* (168 g)		C* (2.3 L)

[1] Noxious Weed as listed under the *Weed Control Act*, R.S.O. 1990, Chapter W.5.

[2] Numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, page 30.

[3] Controls narrow leaved plantain and suppresses broad-leaved plantain.

[4] Must be tank-mixed with 2,4-D to achieve this level of control.

TABLE 18–1. Susceptibility of Various Weeds to Non-Crop Land Herbicides (cont'd)

LEGEND: ✓ = noxious weed x = not noxious C = Controlled, S = Suppressed, TG = Top Growth, NC = Not Controlled
* = weed is listed on the product label for control or suppression – = insufficient information available to make a rating

Weeds	Noxious[1]	2,4-D ESTER (660 g/L)[2]	ARSENAL	CASORON	CLEARVIEW	DIUREX/KARMEX	dichlorprop/2,4-D (610 g/L)[2]	ESCORT	FIESTA	GARLON XRT	glyphosate (360 g/L)[2]	HYVAR X-L	MILESTONE	MUNGER HORT. VINEGAR PLUS	NAVIUS	PAYLOAD	TELAR	TORDON 101	TRUVIST	LONTREL 360	VANQUISH
hemlock, poison (rate/ha)	✓	NC	–	–	–	–	–	–	–	–	C (2% v/v)	–	–	–	–	–	–	–	–	–	–
hogweed, giant (rate/ha)	✓	NC	–	–	C (135 g)	–	–	–	NC	–	C (2% v/v)	–	–	NC	C* (167 g)	–	–	–	C* (168 g)	–	–
horsetail (rate/ha)	x	–	–	C* (175 kg)	–	–	S* (2.75 L)	–	–	–	–	–	–	–	–	–	C* (70 g)	–	–	–	–
horsenettle (rate/ha)	x	–	–	–	C* (135 g)	–	–	–	–	–	C (2% v/v)	–	C* (0.29 L)	–	–	–		–	–	–	–
kochia (rate/ha)	x	C* (1.28 L)	C* (3 L)	–	C* (135 g)	S	C* (2.75 L)	C* (20 g)	–	–	C (1% v/v)	–	–	–	C* (167 g)	–	C* (15 g)	–	C* (168 g)	–	–
knapweed diffuse (rate/ha)	✓	–	–	–	C (135 g)	S* (11.25 kg)	–	–	–	–	–	–	C (0.29 L)	–	C* (167 g)	–	–	–	C* (168 g)	–	C* (4.6 L)
knapweed, Russian (rate/ha)	✓	S* (1.28 L)	–	–	C (135 g)	–	–	–	–	–	–	–	C (0.29 L)	–	–	–	–	–	–	–	C* (9.2 L)
knapweed, spotted (rate/ha)	✓	–	–	–	C* (135 g)	–	–	–	–	–	–	–	C* (0.29 L)	–	C* (167 g)	–	–	–	C* (168 g)	–	–
knotweed, Japanese (rate/ha)	x	–	–	–	–	–	–	–	–	–	C* (2% v/v)	–	–	–	–	–	–	–	–	–	–
kudzu (rate/ha)	✓	–	C (3 L)	–	C (230 g)	–	–	–	–	–	C (2% v/v)	–	–	–	–	–	–	–	C* (168 g)	–	–
lettuce, prickly (rate/ha)	x	C* (1.28 L)	–	–	C* (230 g)	–	–	–	–	C* (2.5 L)	C* (1% v/v)	–	–	–	–	–	–	C* (7 L)	–	–	–
milkweed (rate/ha)	✓	–	C* (3 L)	–		C* (11.25 kg)	C* (2.75 L)	–	–	–	C* (2% v/v)	–	–	–	–	–	–	–	–	–	–

[1] Noxious Weed as listed under the *Weed Control Act*, R.S.O. 1990, Chapter W.5.
[2] Numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, page 30.
[3] Controls narrow leaved plantain and suppresses broad-leaved plantain.
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TABLE 18–1. Susceptibility of Various Weeds to Non-Crop Land Herbicides (cont'd)

LEGEND: ✓ = noxious weed x = not noxious C = Controlled, S = Suppressed, TG = Top Growth, NC = Not Controlled
* = weed is listed on the product label for control or suppression – = insufficient information available to make a rating

Weeds	Noxious[1]	2,4-D ESTER (660 g/L)[2]	ARSENAL	CASORON	CLEARVIEW	DIUREX/KARMEX	dichlorprop/2,4-D (610 g/L)[2]	ESCORT	FIESTA	GARLON XRT	glyphosate (360 g/L)[2]	HYVAR X-L	MILESTONE	MUNGER HORT. VINEGAR PLUS	NAVIUS	PAYLOAD	TELAR	TORDON 101	TRUVIST	LONTREL 360	VANQUISH
parsnip, wild (rate/ha)	✓	–	–	–	S (170 g)	–	S* (2.75 L)	–	–	–	C (2% v/v)	–	S (0.5 L)	–	–	–	–	–	C* (168 g)	–	–
pragmites (common reed) (rate/ha)	x	–	–	–	–	–	–	–	–	–	C* (2% v/v)	–	–	–	–	–	–	–	–	–	–
plantain spp. (rate/ha)	x	C* (1.28 L)	C* (3 L)	–	C*[2] (135 g)	–	–	–	C/S*[3] (4.2% v/v)	–	–	–	–	S* (45% v/v)	–	–	–	C* (7 L)	–	–	–
poison-ivy (rate/ha)	✓	–	C* (3 L)	–	–	–	C* (0.8% v/v)	–	–	–	C* (2% v/v)	–	–	–	–	–	–	–	C* (168 g)	–	C*[4] (1.7 L)
quackgrass (rate/ha)	x	–	–	C* (175 kg)	–	–	–	–	–	–	C* (2% v/v)	C* (45 L)	–	S* (45% v/v)	–	–	–	–	–	–	–
ragweed (rate/ha)	✓	C* (1.28 L)	–	–	–	C* (11.25 kg)	–	–	–	C* (2.5 L)	C* (1% v/v)	C* (45 L)	C* (0.29 L)	S* (45% v/v)	–	C* (0.42 kg)	C* (15 g)	C* (7 L)	C* (168 g)	C* (0.56 L)	C* (2.3 L)
ragwort, tansy (rate/ha)	✓	NC	–	–	–	–	–	–	–	–	–	–	C* (0.38 L)	–	–	–	–	–	–	–	C* (2.3 L)
sorrel, sheep (rate/ha)	x	C* (1.28 L)	C* (3 L)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	C* (0.56 L)	–
spurge, cypress (rate/ha)	✓	–	–	C* (175 kg)	–	–	–	–	–	–	–	–	–	–	C* (167 g)	–	–	–	C* (168 g)	–	–
spurge, leafy (rate/ha)	✓	S* (1.28 L)	C* (3 L)	C* (175 kg)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	C* (1.25 L)
stinging nettle (rate/ha)	x	C* (1.28 L)	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–	–
tansy (rate/ha)	x	–	–	–	C* (135 g)	–	C* (2.75 L)	C* (20 g)	–	–	–	–	–	–	–	–	–	–	–	–	–

[1] Noxious Weed as listed under the *Weed Control Act*, R.S.O. 1990, Chapter W.5.

[2] Numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, page 30.

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LEGEND: ✓ = noxious weed x = not noxious C = Controlled, S = Suppressed, TG = Top Growth, NC = Not Controlled
* = weed is listed on the product label for control or suppression – = insufficient information available to make a rating

Weeds	**Noxious[1]**	**2,4-D ESTER (660 g/L)[2]**	**ARSENAL**	**CASORON**	**CLEARVIEW**	**DIUREX/KARMEX**	**dichlorprop/2,4-D (610 g/L)[2]**	**ESCORT**	**FIESTA**	**GARLON XRT**	**glyphosate (360 g/L)[2]**	**HYVAR X-L**	**MILESTONE**	**MUNGER HORT. VINEGAR PLUS**	**NAVIUS**	**PAYLOAD**	**TELAR**	**TORDON 101**	**TRUVIST**	**LONTREL 360**	**VANQUISH**
teasel (rate/ha)	x	TG* (1.28 L)	–	–	–	–	C* (2.75 L)	–	–	–	–	–	–	–	–	–	–	–	–	–	–
thistle, bull (rate/ha)	x	TG* (1.28 L)	S*	–	C (135 g)	C* (11.25 kg)	C* (2.75 L)	–	C* (4.2% v/v)	–	C (2% v/v)	–	–	–	–	–	–	–	–	–	–
thistle, Canada (rate/ha)	✓	TG* (1.28 L)	–	C* (175 kg)	C* (135 g)	C* (11.25 kg)	C* (2.75 L)	S* (20 g)	C* (4.2% v/v)	–	C* (2% v/v)	–	C* (0.29 L)	S* (45% v/v)	C* (167 g)	–	S* (70 g)	C* (3.7 L)	C* (168 g)	C* (0.56 L)	C* (1.25 L)
thistle, sow (perennial) (rate/ha)	✓	TG* (1.28 L)	–	S*	C* (135 g)	C* (11.25 kg)	C* (2.75 L)	S[4] (20 g)	–	–	C* (2% v/v)	–	C* (0.29 L)	–	C* (167 g)	–	C* (70 g)	–	C* (168 g)	C* (0.56 L)	C* (1.25 L)
thistle, Russian (rate/ha)	x	C* (1.28 L)	–	–	C* (135 g)	–	–	C* (20 g)	–	–	C* (1% v/v)	–	–	–	C* (167 g)	–	C* (15 g)	–	–	–	–
toadflax (rate/ha)	x	–	C* (3 L)	–	–	–	C* (2.75 L)	–	–	–	C* (2% v/v)	–	–	S* (45% v/v)	–	–	–	–	–	–	–
vetch (rate/ha)	x	S (1.28 L)	C* (3 L)	S*	–	–	C* (2.75 L)	–	–	C* (2.5 L)	–	–	–	S* (45% v/v)	–	–	–	C* (7 L)	–	C* (0.42 L)	–
wormwood, biennial (rate/ha)	x	S* (1.28 L)	–	S*	C* (230 g)	–	–	–	–	–	C* (2% v/v)	–	C* (0.5 L)	–	–	–	–	–	–	–	C* (1.25 L)
yarrow (rate/ha)	x	–	–	–	S* (230 g)	–	–	–	–	–	–	–	–	–	–	–	–	C* (3.7 L)	–	–	–
yellow rocket	x	TG* (1.28 L)	–	–	–	–	C* (2.75 L)	–	–	–	–	–	–	–	–	–	–	–	–	–	–

[1] Noxious Weed as listed under the *Weed Control Act*, R.S.O. 1990, Chapter W.5.
[2] Numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, page 30.
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TABLE 18–2. Herbicide Treatment Rates for Roadsides and Non-Crop Areas

POISONOUS PLANT MANAGEMENT
GIANT HOGWEED

Giant hogweed is a monocarpic perennial weed, meaning the same plant will grow for more than 2 years but only flowers and produces seed once during its lifetime. Once seed is produced, the plant dies. New plants are established only from seed. Therefore the strategy for limiting the spread and movement of giant hogweed is to stop seed production. New seedlings will germinate in the spring and in the fall, therefore the most appropriate time of year to remove plants is in late April or early May and September. Management strategies at this stage will remove young seedlings as well as established plants that have not yet bolted and produced seed. Risk of dermatitis is also reduced since plants are typically less than 30 cm in height making it unlikely that you would come into contact with the plants sap. Extreme heat and humidity are also avoided which make wearing appropriate protective clothing more comfortable.

The application of non-selective herbicides with a back-pack sprayer should never be used on a plant that has already flowered. Experience has shown that back-pack sprayer applications made to a large plant results in a significant amount of the non-selective herbicide missing the target and taking out the surrounding grass vegetation which only serves to provide an ideal environment for new seedlings to germinate. The use of an injection gun for applying non-selective herbicides should be used on giant hogweed plants that have bolted and are flowering.

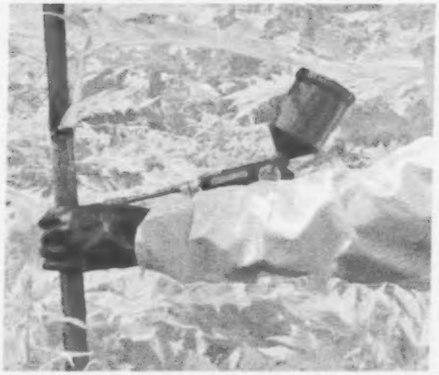

Figure 18–1. Jet injector gun injecting 10 mL of a 5% glyphosate solution with a jet injector gun.

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4. Herbicides Used in Ontario, page 27 and Chapter 5. Notes on Adjuvants, page 81.
Spot Applications: Late April/Early May (ideal plant stage: 30 cm in height or less)			
glyphosate (720 g/100 L water)	glyphosate (360 g/L)*	2 L/100 L water	· Best applied as a spot application using a backpack sprayer. · Apply to actively growing plants. · Spray coverage should be uniform and complete. · **Do NOT** spray to the point of runoff. · Evaluate treated area 10–14 days after application to identify and treat any plants missed during the first application. * See Table 4–1. Herbicides Used in Ontario, page 30 for formulations available. See label for specific uses and rates.
metsulfuron-methyl 12.6%/ aminocyclopyrachlor 39.5%	NAVIUS™ VM HERBICIDE (52.1%)	167 g/ha (68 g/acre)	· For best results, apply to young, actively growing weeds up to 4-leaf. Thorough coverage is essential. · Spray coverage should be uniform and complete · **Do NOT** spray to the point of runoff
chlorsulfuron 15.8%/ aminocyclopyrachlor 39.5%	TRUVIST™ HERBICIDE (55.3%)	168 g/ha (68.02 g/acre)	· For best results, apply to young, actively growing weeds up to 4-leaf. Thorough coverage is essential. · Spray coverage should be uniform and complete · **Do NOT** spray to the point of runoff

Research Update: Ontario populations of giant hogweed have been documented to grow as quickly as 10 cm per day in early spring. Many online sources have suggested that cutting the flowering head is an effective way to stop seed production however Ontario research trials have documented that the plant will produce a new flower within 7–10 days of cutting. It has also been suggested that cutting the root just below the soil surface will kill giant hogweed plants but the tap root of giant hogweed has been documented to persist deeper than 1.5 m and removal of its root as a management strategy mirrors that of dandelion in that unless the majority or all of the root is removed, new vegetative material can arise from the taproot.

TABLE 18–2. Herbicide Treatment Rates for Roadsides and Non-Crop Areas (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4. Herbicides Used in Ontario, page 27 and Chapter 5. Notes on Adjuvants, page 81.
GIANT HOGWEED (cont'd)			
Stem Injection (See Figure 18–1): Late May/Early June (plants that are between 1–2 m tall)			
glyphosate	glyphosate (360 g/L)*	10 mL of a 5% glyphosate solution/ plant	· Best for small patches of giant hogweed that have gotten too large for spot applications with a backpack sprayer. · Insert the injection gun at about chest height but below a node on the stem. · Stem injections are best done with a jet injector gun which can be purchased at www.jkinjectiontools.com (See Figure 18–1, on page 426). * See Table 4–1. Herbicides Used in Ontario, page 30 for formulations available. See label for specific uses and rates.
PARSNIP, WILD			
Wild parsnip is a biennial/perennial weed that reproduces by seed. The majority of seed germinates in the spring but will also germinate in the late summer and early fall. Therefore, applications should be timed in the early part of spring to control seedlings and then again in the fall to control established first year rosette plants that were missed in the spring as well as any newly emerged seedlings. Hand spudding that cuts off the root below ground is effective control for small patches.			
April/May and Sept/Oct			
glyphosate (720 g/100 L water)	glyphosate (360 g/L)*	2 L/ 100 L water	· Best applied as a spot application using a backpack sprayer. · Apply to actively growing plants. · Spray coverage should be uniform and complete. · **Do NOT** spray to the point of runoff. · Evaluate treated area 10–14 days after application to identify and treat any plants missed during the first application. * See Table 4–1. Herbicides Used in Ontario, page 30 for formulations available. See label for specific uses and rates.
chlorsulfuron 15.8%/ aminocyclopyrachlor 39.5%	TRUVIST™ HERBICIDE (55.3%)	168 g/ha (68.02 g/acre)	· For best results, apply to young, actively growing weeds up to 4-leaf. Thorough coverage is essential. · Spray coverage should be uniform and complete · **Do NOT** spray to the point of runoff

TABLE 18–2. Herbicide Treatment Rates for Roadsides and Non-Crop Areas (cont'd)

<table>
<tr><th>ACTIVE INGREDIENT (rate)</th><th>TRADE NAME (concentration)</th><th>PRODUCT RATE</th><th>PRECAUTIONS
For more information, see Chapter 4. Herbicides Used in Ontario, page 27 and Chapter 5. Notes on Adjuvants, page 81.</th></tr>
<tr><td colspan="4">POISON-IVY</td></tr>
<tr><td colspan="4">Several herbicides have been shown to be effective for the control of poison-ivy. However, some growth may occur after treatment with any of these chemicals and re-treatment will be necessary to achieve eradication. The use of a herbicide treatment for poison-ivy must take into account the location in which the weed is growing. If desirable vegetation is close by exercise caution when applying herbicides so as to avoid off-target drift.
A 9–14 L sprayer is the most convenient method of applying herbicides to patches of poison-ivy. Thorough coverage of the leaves with the spray is essential for maximum effect. After spraying, leave the area alone until the plants die, at which time gather and bury the dead stems. Even at this stage poisoning may be brought about by handling the dead plant so protective clothing (e.g., rubber gloves, rain suit) is advised. All treatments are most effective when poison-ivy is in full leaf and growing actively, from about June 15–July 31.</td></tr>
<tr><td colspan="4">Postemergence to Poison-Ivy</td></tr>
<tr><td>imazapyr
(0.72 kg/ha)</td><td>ARSENAL POWERLINE
(240 g/L)</td><td>3 L/ha (1.2 L/acre)</td><td>· Apply in sufficient water (100–550 L/ha (40–220 L/acre)) to wet all foliage during periods of active growth.</td></tr>
<tr><td rowspan="2">dichlorprop/2,4-D</td><td>dichlorprop/2,4-D (610 g/L)*</td><td>8 L/1,000 L water</td><td rowspan="2">· Best applied as a spot application using a backpack sprayer.
· Apply spray until foliage is thoroughly wet.
* See Table 4–1. Herbicides Used in Ontario, page 30 for formulations available. See label for specific uses and rates.</td></tr>
<tr><td>dichlorprop/2,4-D (582 g/L)*</td><td>11.7 L/1,000 L water</td></tr>
<tr><td>glyphosate
(720 g/100 L water)</td><td>glyphosate (360 g/L)*</td><td>2 L/100 L water</td><td>· Best applied as a spot application using a backpack sprayer.
· Apply to actively growing plants.
· Spray coverage should be uniform and complete.
· Do NOT spray to the point of runoff.
* See Table 4–1. Herbicides Used in Ontario, page 30 for formulations available. See label for specific uses and rates.</td></tr>
<tr><td>chlorsulfuron 15.8%/
aminocyclopyrachlor 39.5%</td><td>TRUVIST™ HERBICIDE (55.3%)</td><td>168 g/ha (68.02 g/acre)</td><td>· For best results, apply to young, actively growing weeds up to 4-leaf. Thorough coverage is essential.
· Spray coverage should be uniform and complete
· Do NOT spray to the point of runoff</td></tr>
<tr><td rowspan="3">dicamba
(0.82 kg/ha)
+ 2,4-D
(1.1 kg/ha)</td><td>VANQUISH (480 g/L)
+ 2,4-D Amine (470 g/L)*</td><td rowspan="3">1.7 L/ha (0.68 L/acre)
+ 2.2 L/ha (0.88 L/acre)</td><td rowspan="3">· Apply in at least 560 L/ha water (224 L/acre).
* See Table 4–1. Herbicides Used in Ontario, page 30 for formulations available. See label for specific uses and rates.</td></tr>
<tr><td>ORACLE (480 g/L)
+ 2,4-D Amine (470 g/L)*</td></tr>
<tr><td>VMD (480 g/L)
+ 2,4-D Amine (470 g/L)*</td></tr>
<tr><td colspan="4">INVASIVE PLANT MANAGEMENT</td></tr>
<tr><td colspan="4">The impact of invasive species on crop land, native ecosystems, habitats and species is severe and often irreversible. The following section outlines best management practices based on herbicides that list the specific invasive species on their label as well as experience gained through public research trials conducted in Ontario.</td></tr>
<tr><td colspan="4">Bedstraw, Smooth – rangeland, permanent pasture and non-crop areas</td></tr>
<tr><td>triclopyr
(0.45–1.89 kg/ha)</td><td>GARLON XRT (755 g/L)</td><td>0.6–2.5 L/ha (0.24–1 L/acre)</td><td>· Apply in 200–300 L/ha water (80–120 L/acre) when smooth bedstraw is actively growing. Use rates at higher end of the range as smooth bedstraw gets larger.
· Do NOT allow livestock to consume treated forage for 14 days following treatment.
· Do NOT harvest treated forage for 14 days following treatment.</td></tr>
</table>

TABLE 18–2. Herbicide Treatment Rates for Roadsides and Non-Crop Areas (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4. Herbicides Used in Ontario, page 27 and Chapter 5. Notes on Adjuvants, page 81.
Dog Strangling Vine – rangeland, permanent pasture and non-crop areas			
imazapyr (0.72 kg/ha)	ARSENAL POWERLINE (240 g/L)	3 L/ha (1.2 L/acre)	· Apply in sufficient water (100–550 L/ha (40–220 L/acre)) to wet all foliage during periods of active growth (early May for dog strangling vine). · **Do NOT** graze the treated area or cut for hay. · **Do NOT** apply in areas where tree roots may extend into the treated area. · This product can only be applied by licensed applicators.
Research Update: Dog strangling vine is a prolific seed producer, establishes dense stands throughout the growing season and produces multiple stems from the crowns of established plants. Effective control will require a systemic herbicide to control established plants, and if using a non-residual herbicide, a follow-up application will be needed to control new seedlings. Herbicide choice will be determined by current and planned uses for the site. Experimentation is underway to label additional products for dog strangling vine control, specifically NAVIUS VM herbicide.			
Garlic Mustard – forested areas			
Research Update: A study conducted by Dr. Stephen Murphy (University of Waterloo) demonstrated that by planting bloodroot (Sanguinaria canadensis) at a density of 11 plant/m^2 or greater reduced populations of garlic mustard in wooded areas.			
Phragmites (Common Reed) — non-crop areas			
glyphosate (720 g/100 L water)	ROUNDUP WEATHERMAX	1.34 L/100 L water	· Best applied as a spot application using a backpack sprayer. · Apply to actively growing plants in full bloom, typically in later summer or early fall. · Spray coverage should be uniform and complete. · **Do NOT** spray to the point of runoff. · **Do NOT** spray if there is standing water in the area where the phragmites exist. · A BMP document can be found at www.ontarioinvasiveplants.ca.
	VISION MAX (540 g/L)		
Purple Loosestrife — non-crop areas			
glyphosate (720 g/100 L water)	glyphosate (360 g/L)*	2 L/100 L water	· Best applied as a spot application using a backpack sprayer. · Apply to actively growing plants. · Spray coverage should be uniform and complete. · **Do NOT** spray to the point of runoff. * See Table 4–1. Herbicides Used in Ontario, page 30 for formulations available. See label for specific uses and rates.
Bio-Control Options: Galerucella beetles have provided effective biological control of purple loosestrife. The only known source of these beetles is Ontario Beetles, P.O. Box 458, Paris, ON, N3L 3T5. Phone number: 519-442-3921.			
Wild Chervil — rangeland, permanent pasture and non-crop areas			
glyphosate (720 g/100 L water)	glyphosate (360 g/L)*	2 L/ 100 L water	· Best applied as a spot application using a backpack sprayer. · Apply to actively growing plants. · Spray coverage should be uniform and complete. · **Do NOT** spray to the point of runoff. * See Table 4–1. Herbicides Used in Ontario, page 30 for formulations available. See label for specific uses and rates.

TABLE 18–2. Herbicide Treatment Rates for Roadsides and Non-Crop Areas (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4. Herbicides Used in Ontario, page 27 and Chapter 5. Notes on Adjuvants, page 81.
Wild Chervil — rangeland, permanent pasture and non-crop areas (cont'd)			
metsulfuron-methyl 12.6%/ aminocyclopyrachlor 39.5%	NAVIUS™ VM HERBICIDE (52.1%)	167 g/ha (68 g/acre)	· For best results, apply to young, actively growing weeds up to 4-leaf. Thorough coverage is essential. · Spray coverage should be uniform and complete · **Do NOT** spray to the point of runoff
chlorsulfuron 15.8%/ aminocyclopyrachlor 39.5%	TRUVIST™ HERBICIDE (55.3%)	168 g/ha (68.02 g/acre)	· For best results, apply to young, actively growing weeds up to 4-leaf. Thorough coverage is essential. · Spray coverage should be uniform and complete · **Do NOT** spray to the point of runoff

RIGHTS-OF-WAY AND ROADSIDE VEGETATION MANAGEMENT

The main objectives of a weed control program for rights-of-way (ROW) and roadsides are: (1) to ensure ROW and highway access, safety and security; (2) to control weeds during establishment of seeded cover; (3) to control noxious and other weeds that may infest adjacent land by wind dispersal of seed; (4) to maintain a perennial, deep-rooted plant cover that will minimize erosion problems; (4) to control tall growing weeds so that mowing costs can be minimized; and (5) to prevent buildup of excessive vegetation that can become a fire hazard in the late summer or complicate snow removal in winter. Refer to Table 18–1. Susceptibility of Various Weeds to Non-Crop Land Herbicides, page 421 to identify weed species controlled by herbicides outlined in this section.

Postemergence Broadleaf Herbicides			
2,4-D	2,4-D Amine 600 (564 g/L)*	up to 3.9 L/ha (1.56 L/acre)	· Apply in 100–300 L/ha water (40–120 L/acre) at the time of rapid weed growth (typically May, June and/or September). · Use the higher rate for larger weeds, dry or cold weather, or heavy infestations. · **Do NOT** apply more than two treatments per year. * See Table 4–1. Herbicides Used in Ontario, page 30 for formulations available. See label for specific uses and rates.
	2,4-D Ester 600 (564 g/L)*	1.5–2.75 L/ha (0.6–1.1 L/acre)	
	2,4-D Ester 700 (660 g/L)*	1.28–2.35 L/ha (0.51–0.94 L/acre)	
aminopyralid/ metsulfuron-methyl (83.6–142.5 g/ha)	CLEARVIEW (52.5/9.45%)	135–230 g/ha (54–92 g/acre)	· Apply in a minimum of 110–200 L/ha water (44–80 L). · Product rates vary depending on the type of weed species targeted. Refer to Table 18–1. Susceptibility of Various Weeds to Non-Crop Land Herbicides, page 421 for the appropriate rate.
dichlorprop/2,4-D	dichlorprop/2,4-D (610 g/L)*	2.75 L/ha (1.1 L/acre)	· Apply in 200–600 L/ha water (80–240 L/acre) during early summer for most species. · Some weed species may require a second application.
	dichlorprop/2,4-D (582 g/L)*	4 L/ha (1.6 L/acre)	* See Table 4–1. Herbicides Used in Ontario, page 30 for formulations available. See label for specific uses and rates.
metsulfuron methyl (12–18 g/ha)	ESCORT (60%) + non-ionic surfactant	20–30 g/ha (8–12 g/acre) + 0.2% v/v	· Product rates vary depending on the type of weed species targeted. Refer to Table 18–1. Susceptibility of Various Weeds to Non-Crop Land Herbicides, page 421 for the appropriate rate. · Apply postemergence to young (less than 10 cm tall or across) annual weeds, biennial and perennial weeds up to the early bud stag. Weeds should be actively growing at the time of application. · Temporary chlorosis, height reduction or growth suppression of desired grass species may occur.

TABLE 18–2. Herbicide Treatment Rates for Roadsides and Non-Crop Areas (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4. Herbicides Used in Ontario, page 27 and Chapter 5. Notes on Adjuvants, page 81.
RIGHTS-OF-WAY AND ROADSIDE VEGETATION MANAGEMENT (cont'd)			
Postemergence Broadleaf Herbicides (cont'd)			
triclopyr (0.45–1.89 kg/ha)	GARLON XRT (755 g/L)	0.6–2.5 L/ha (0.24–1 L/acre)	· Apply in 200–300 L/ha water (80–120 L/acre) when weeds are actively growing. · **Do NOT** allow livestock to consume treated forage for 14 days following treatment. · **Do NOT** harvest treated forage for 14 days following treatment.
clopyralid (0.15–0.3 kg/ha)	LONTREL (360 g/L)	0.42–0.83 L/ha (0.17–0.33 L/acre)	· For Canada thistle, perennial sow-thistle, spotted knapweed and coltsfoot. · Treat when weeds are young and actively growing. · For coltsfoot, treatments should be performed prior to August. · Apply as a broadcast foliar in 200 L/ha water (80 L/acre) or in sufficient water to ensure thorough coverage of target vegetation. · For spot treatment apply in 800 L and spray weeds to the point of run-off.
aminopyralid (60–120 g/ha)	MILESTONE (240 g/L)	0.25–0.5 L/ha (0.10–0.20 L/acre)	· Apply postemergence. · Will control: absinth (biennial) wormwood, goldenrod, knapweed, scentless chamomile, Canada thistle, yellow star thistle, musk (nodding) thistle, sulphur cinquefoil and tropical soda apple. · Will suppress common tansy and dandelion.
aminopyralid (60–120 g/ha) + 2,4-D amine (840–1,440 g/ha)	MILESTONE (240 g/L) + 2,4-D Amine 600 (564 g/L)*	0.25–0.5 L/ha (0.10–0.20 L/acre) + 1.49–2.55 L/ha (0.6–1 L/acre)	· Apply postemergence. · The addition of 2,4-D provides a broader spectrum of control than MILESTONE applied alone. * See Table 4–1. Herbicides Used in Ontario, page 30 for formulations available. See label for specific uses and rates.
metsulfuron-methyl 12.6%/ aminocyclopyrachlor 39.5%	NAVIUS™ VM HERBICIDE (52.1%)	167 g/ha (68 g/acre)	· For best results, apply to young, actively growing weeds up to 4-leaf. Thorough coverage is essential. · Spray coverage should be uniform and complete · **Do NOT** spray to the point of runoff
chlorsulfuron (53 g/ha)	TELAR (75 DF)	75 g/ha (30 g/acre)	· Add a surfactant to improve control.
picloram/ 2,4-D (1.12–2.14 kg/ha)	TORDON 101 ((1:3.7) 305 g/L)	3.7–7 L/ha (1.48–2.8 L/acre)	· Apply in 200 L/ha water (80 L/acre) during the spring or early summer after growth appears. Use an approved drift control additive or system. · The lower rate will only control Canada thistle, dandelion and common yarrow. · A permit for purchase and use of this product is required.
chlorsulfuron 15.8%/ aminocyclopyrachlor 39.5%	TRUVIST™ HERBICIDE (55.3%)	168 g/ha (68.02 g/acre)	· For best results, apply to young, actively growing weeds up to 4-leaf. Thorough coverage is essential. · Spray coverage should be uniform and complete · **Do NOT** spray to the point of runoff
dicamba (0.6–4.416 kg/ha)	VANQUISH (480 g/L)	1.25–9.2 L/ha (0.5–3.68 L/acre)	· Apply when weeds are actively growing in 100–200 L/ha water (40–80 L/acre). · Refer to Table 18–1. Susceptibility of Various Weeds to Non-Crop Land Herbicides, page 421 for the appropriate product rate needed to control the target weed species.
	ORACLE (480 g/L)		
	VMD (480 g/L)		

TABLE 18–2. Herbicide Treatment Rates for Roadsides and Non-Crop Areas (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4. Herbicides Used in Ontario, page 27 and Chapter 5. Notes on Adjuvants, page 81.
RIGHTS-OF-WAY AND ROADSIDE VEGETATION MANAGEMENT (cont'd)			
Postemergence Grass and Broadleaf Herbicides			
diuron (9 kg/ha)	DIUREX 80WDG	11.25 kg/ha (4.5 kg/acre)	· Apply in sufficient water (250–400 L/ha (100–160 L/acre)). · The level and duration of weed control may be affected by soil type and organic matter. A sandier soil, low in organic matter may exhibit longer periods of weed control versus a heavier clay soil that is high in organic matter.
	KARMEX (80 DF)		
iron (FeHEDTA)	FIESTA (4.43%)	1 L/24 L of water	· Apply the mixed solution at a rate of 200–400 mL/m². Use the 200 mL/m² rate for small weeds and 400 mL/m² on larger weeds. · 1 L of product will treat 62.5–125 m². · Uniform coverage is needed to control target weeds. · Repeat application four or more weeks after the first treatment if necessary. · **Do NOT** apply more than 2 times per year. · **Do NOT** apply if rainfall is expected within 3 hours of application.
glyphosate (3.6–7.2 kg/1,000 L)	glyphosate (360 g/L)*	10–20 L/1,000 L	· Most woody and herbaceous species are controlled. Can be applied as spot treatment during June, July or August. Refer to label for optimum weed stage for best control. · Injury to grasses will occur; use other selective products if grasses are to be maintained. * See Table 4–1. Herbicides Used in Ontario, page 30 for formulations available. See label for specific uses and rates.
	glyphosate (480 g/L)*	7.5–15 L/1,000 L	
	glyphosate (500 g/L)*	7.2–14.4 L/1,000 L	
	glyphosate (540 g/L)*	6.67–13.3 L/1,000 L	
bromacil (7.2–10.8 kg/ha)	HYVAR X-L (240 g/L)	30–45 L/ha (12–18 L/acre)	· Use higher rates on soils with greater than 5% organic matter or on clay soil.
bromacil/diuron (10.8–14.4 kg/ha)	KROVAR ((1:1) 80 DF)	13.5–18 kg/ha (5.4–7.2 kg/acre)	· Use higher rates on soils with greater than 5% organic matter or on clay soil. · **Do NOT** treat sites that are adjacent to and surrounding water supply reservoirs, supply streams, lakes and ponds.
citric acid	MUNGER HORTICULTURAL VINEGAR PLUS (20%)	1 L/3 L of water	· Best results are achieved on sunny days with temperatures at or above 21°C and when weeds are small (3–5 leaf) and actively growing. · A rate of 1 L product/2.25 L water should be used for larger weeds and may require re-treatment. · Complete coverage is needed to control target weeds. · Repeat application four or more weeks after the first treatment if necessary. · **Do NOT** apply to desirable plants. · **Do NOT** apply if rainfall is expected within 1 hour of application.

TABLE 18–2. Herbicide Treatment Rates for Roadsides and Non-Crop Areas (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more Information, see Chapter 4. Herbicides Used In Ontario, page 27 and Chapter 5. Notes on Adjuvants, page 81.
VEGETATION MANAGEMENT – LONG TERM NON-SELECTIVE			
In certain areas (such as in rights-of-way facilities yards, in storage yards, on railway tracks, beneath guide rails, and under fences at road intersections), it may be necessary to completely kill all vegetation for long-term control for safety, access and flammability concerns. **CAUTION:** These chemicals should not be used to treat areas that are close to gardens, desirable trees, etc. Since these chemicals are non-selective (will kill any plant that they contact), special care must be used in their application. If the area (for example, a facilities yard) is higher than a nearby lawn, the chemical may wash onto the lawn with the first rain. If trees or shrubs are feeding under the treated areas, the chemical may leach to their roots and cause injury. It may be desirable to maintain certain areas completely free of vegetation. Usually two problems are involved. First, the existing vegetation must be destroyed, including the destruction of underground stems and roots of perennials. Second, the bare area thus produced must be maintained either by persistent soil active chemicals or by foliage treatment of emerged weed seedlings and plants. Some chemicals will kill existing vegetation. Others, while excellent for maintaining the bare area, may be used more economically if combined with another chemical to kill existing growth. If a mixed population of weeds is present, combinations of chemicals that will kill the different weed types may be used advantageously. Uniform coverage with all chemicals is essential. Touch up operations should be expected, as a single treatment will seldom give complete eradication. Usually 2 applications of the lower label rate (e.g., 5.5–11 kg/ha), depending on the chemical used, spaced 6–12 months apart, give better results than a single application of the higher label rate. This approach also reduces the risk of off-site movement.			
Bare Areas – Non selective control of all vegetation			
imazapyr (0.72 kg/ha)	ARSENAL POWERLINE (240 g/L)	3 L/ha (1.2 L/acre)	· Apply in sufficient water (100–550 L/ha (40–220 L/acre)) to wet all foliage during periods of active growth. · **Do NOT** graze the treated area or cut for hay. · **Do NOT** apply in areas where tree roots may extend into the treated area.
diuron (9 kg/ha)	DIUREX 80WDG	11.25 kg/ha (4.5 kg/acre)	· Apply in sufficient water (250–400 L/ha (100–160 L/acre)). · The level and duration of weed control may be affected by soil type and organic matter. A sandier soil, low in organic matter may exhibit longer periods of weed control versus a heavier clay soil that is high in organic matter.
	KARMEX (80 DF)		
glyphosate (3.6–7.2 kg/1,000 L)	glyphosate (360 g/L)*	10–20 L/1,000 L	· Controls established plants of most woody and herbaceous species. Can be applied whenever plants are green and actively growing. · No residual control is provided. * See Table 4–1. Herbicides Used in Ontario, page 30 for formulations available. See label for specific uses and rates.
	glyphosate (480 g/L)*	7.5–15 L/1,000 L	
	glyphosate (500 g/L)*	7.2–14.4 L/1,000 L	
	glyphosate (540 g/L)*	6.67–13.3 L/1,000 L	
bromacil (6.16–10.8 kg/ha)	HYVAR X-L (240 g/L)	25.7–45 L/ha (10.3–18 L/acre)	· Mullein is not adequately controlled by HYVAR X-L.
bromacil/diuron (10.8–14.4 kg/ha)	KROVAR ((1:1) 80 DF)	13.5–18 kg/ha (5.4–7.2 kg/acre)	· **Do NOT** treat sites that are adjacent to and surrounding water supply reservoirs, supply streams, lakes and ponds.
flumioxazin (0.143–0.286 kg/ha) + glyphosate (1.2 kg/ha)	PAYLOAD WDG (51.1%) + glyphosate (360 g/L)*	280–420 g/ha (112–168 g/acre) + 3.3 L/ha (1.3 L/acre)	· **Do NOT** apply on soils with > 5% organic matter, or fine textured soils. · **Do NOT** apply to farm alleys or roads where traffic may result in treated dust settling onto crops or other desirable vegetation. · **Do NOT** apply with 100 metres of non-dormant pears. · **Do NOT** make more than two applications per growing season. · Apply high rate to medium textured soils. · Apply low rate to coarse textured soils. · This tank-mix provides residual control only for pigweed spp. common ragweed, lamb's-quarters, green foxtail, hairy nightshade, dandelion and eastern black nightshade. * See Table 4–1. Herbicides Used in Ontario, page 30 for formulations available. See label for specific uses and rates.

Strategies for Managing Woody Species

There are several techniques that may be used for the herbicide control of woody species such as stem foliage sprays, basal bark sprays and frilling or stump treatments (internet search: "frilling" to see a video of this technique). The choice of technique will depend on such factors as targeted woody plant species, accessibility of land, availability of equipment, proximity to susceptible crops or ornamental vegetation and the size of the control program.

Foliage Treatment

Foliage treatment of brush is more appropriate for smaller growth (less than 3 m in height). Treatments should be applied to thoroughly wet the foliage just to the point of runoff. This technique is most effective just after full leaf development in late spring or early summer.

Basal Bark Treatment

The basal bark treatment is useful on a wide range of trees and brush with a trunk diameter up to 10 cm. Basal bark treatments use a low-pressure backpack sprayer to wet the lower 30–45 cm of the stem using a solid cone or flat fan nozzle. It is important to thoroughly wet the entire stem, root collar area, and any exposed roots. Basal bark herbicides use an oil carrier to penetrate the bark.

Stump Treatment

In many cases, it is more desirable to remove existing brush by hand than to spray it and leave the dead material standing. Cut-stump treatment is used for trees 10 cm and above in areas where a falling dead tree (following basal bark treatment) could be hazardous. Most treatments must be applied to freshly cut stumps to achieve maximum effectiveness.

Tree Injection

Glyphosate as a 0.15 g EZJECT capsule can be used to control woody brush and trees with an EZJECT capsule injection system. Capsules must penetrate through the outer bark and into the inner living tissue to provide effective results. Capsules should be spaced evenly around the tree, below all major branches at a rate of 1 capsule per 5 cm stem diameter at breast height (dbh). Stems should be in excess of 3 cm in diameter but usually not in excess of 20 cm in diameter. Trees should not be frozen at time of treatment. Allow 1–2 years for complete control.

TABLE 18–3. Susceptibility of Woody Plants to Various Herbicides and Mixtures as Foliage Sprays

LEGEND: ✓ = noxious weed x = not noxious C = Controlled, S = Suppressed, TG = Top Growth, NC = Not Controlled
* = weed is listed on the product label for control or suppression – = insufficient information available to make a rating

Common Name	Noxious[1]	2,4-D[2]	ARSENAL POWERLINE	dichlorprop/2,4-D[2] (610 g/L)	dicamba/2,4-D[2]	GARLON XRT	glyphosate (360 g/L)[2]	NAVIUS	TORDON 101
alder (rate/ha)	x	C/S	–	C* (0.8% v/v)	C* (2.1 L + 3.3 L)	C* (2.5 L/ha)	C* (2% v/v)	–	C* (17.3 L/ha)
arborvitae	x	NC	–	NC	C	–	–	–	C
ash (rate/ha)	x	NC	–	C/S	C* (5.2 L + 7.1 L)	C* (2.5 L/ha)	–	C* (334 g/ha)	S/NC
aspen (rate/ha)	x	–	–	C* (0.8% v/v)	–	C* (2.5 L/ha)	–	–	–
barberry, common	✓	S	–	C	–	–	–	–	C/S
basswood (rate/ha)	x	NC	–	C* (0.8% v/v)	C* (4 L + 6.6 L)	C* (2.5 L/ha)	–	–	C
beech (rate/ha)	x	NC	–	–	S	C* (2.5 L/ha)	–	–	C
birch (rate/ha)	x	C	–	C* (0.8% v/v)	C* (4 L + 6.6 L)	C* (2.5 L/ha)	C* (2% v/v)	–	C* (17.3 L/ha)
birch, white (paper) (rate/ha)	x	–	–	–	C* (4.2 L + 6.6 L)	–	–	–	–
blackberry (rate/ha)	x	NC	–	–	S/NC	C* (2.5 L/ha)	–	–	C/S
blueberry	x	C	–	C	S/NC	C/S	–	–	C
buckbush (rate/ha)	x	–	–	C (0.6% v/v)	–	–	–	–	–
buckthorn (rate/ha)	✓	S/NC	–	–	S/NC	C* (2.5 L/ha)	–	–	C
cedar (rate/ha)	x	NC	–	C (0.6% v/v)	C	–	–	–	C* (17.3 L/ha)
cherry, black, red (rate/ha)	x	C/S	–	C* (0.6% v/v)	C* (2.1 L + 3.3 L)	C* (5 L/ha)	C* (2% v/v)	–	C
cherry, choke (rate/ha)	x	C/S*	–	C	C	C* (5 L/ha)	–	C* (334 g/ha)	C
cottonwood, black (rate/ha)	x	–	–	–	C* (4 L + 6.6 L)	C* (2.5 L/ha)	–	–	–
cranberry	x	C	–	–	–	–	–	–	–
creeper, Virginia	x	C	–	C/S	C	–	–	–	C
currants, wild	x	NC	–	–	C	–	–	–	–
dogwood (rate/ha)	x	C/S	–	C	–	C* (2.5 L/ha)	–	–	C

[1] Noxious Weed as listed under the *Weed Control Act*, R.S.O. 1990, Chapter W.5.

[2] Numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, page 30.

TABLE 18–3. Susceptibility of Woody Plants to Various Herbicides and Mixtures as Foliage Sprays (cont'd)

LEGEND: ✓ = noxious weed x = not noxious C = Controlled, S = Suppressed, TG = Top Growth, NC = Not Controlled
* = weed is listed on the product label for control or suppression – = insufficient information available to make a rating

Common Name	Noxious[1]	2,4-D[2]	ARSENAL POWERLINE	dichlorprop/2,4-D[2] (610 g/L)	dicamba/2,4-D[2]	GARLON XRT	glyphosate (360 g/L)[2]	NAVIUS	TORDON 101
elderberry (rate/ha)	x	C	–	C* (0.8% v/v)	C/S	C* (2.5 L/ha)	–	–	C
elm (rate/ha)	x	S	–	C* (0.8% v/v)	C* (4 L + 6.6 L)	C* (5 L/ha)	–	–	C
fir, balsam (rate/ha)	x	NC	–	C* (0.8% v/v)	C* (4 L + 6.6 L)	S/NC	–	C* (334 g/ha)	C
grape, wild	x	C	–	C	C	C	–	–	C
hardhack, spirea (rate/ha)	x	S	–	C* (0.8% v/v)	–	–	–	–	C
hawthorn (rate/ha)	x	S/NC	–	C* (0.6% v/v)	C/S	C* (2.5 L/ha)	–	–	C
hemlock (rate/ha)	x	NC	–	–	–	–	–	–	C
hickory, black, shagbark (rate/ha)	x	NC	–	C* (0.8% v/v)	C* (4 L + 6.6 L)	C* (2.5 L/ha)	–	–	–
honeysuckle (rate/ha)	x	C/S	–	C* (0.8% v/v)	C	–	–	–	C
ironwood	x	NC	–	C/S	C	C	–	–	C
juniper (rate/ha)	x	NC	–	C* (0.8% v/v)	C	–	–	–	C/S
lilac	x	S/NC	–	–	–	–	–	–	C
locust, black (rate/ha)	x	S	–	–	–	C* (2.5 L/ha)	–	–	C
locust, honey (rate/ha)	x	C/S	–	–	–	C* (5 L/ha)	–	–	C
maple, Manitoba (rate/ha)	x	C/S	C* (3 L/ha)	C* (0.8% v/v)	C	C* (5 L/ha)	C* (2% v/v)	C* (334 g/ha)	C* (17.3 L/ha)
maple, red (rate/ha)	x	NC	C* (3 L/ha)	S/NC	S/NC	C* (5 L/ha)	C* (2% v/v)	C* (334 g/ha)	C* (17.3 L/ha)
maple, silver (rate/ha)	x	C/S	C* (3 L/ha)	C* (0.8% v/v)	–	C* (5 L/ha)	C* (2% v/v)	–	C* (17.3 L/ha)
maple, sugar (rate/ha)	x	NC	C* (3 L/ha)	C* (0.8% v/v)	C* (5.2 L + 7.1 L)	C* (5 L/ha)	C* (2% v/v)	C* (334 g/ha)	C* (17.3 L/ha)
oak, red (rate/ha)	x	S	–	S/NC	C* (4 L + 6.6 L)	C* (5 L/ha)	–	C* (334 g/ha)	C/S

[1] Noxious Weed as listed under the *Weed Control Act*, R.S.O. 1990, Chapter W.5.
[2] Numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, page 30.

TABLE 18–3. Susceptibility of Woody Plants to Various Herbicides and Mixtures as Foliage Sprays (cont'd)

LEGEND: ✓ = noxious weed x = not noxious C = Controlled, S = Suppressed, TG = Top Growth, NC = Not Controlled
* = weed is listed on the product label for control or suppression – = insufficient information available to make a rating

Common Name	**Noxious[1]**	**2,4-D[2]**	**ARSENAL POWERLINE**	**dichlorprop/2,4-D[2] (610 g/L)**	**dicamba/2,4-D[2]**	**GARLON XRT**	**glyphosate (360 g/L)[2]**	**NAVIUS**	**TORDON 101**
oak, white (rate/ha)	x	S	–	C* (0.8% v/v)	C/S	C* (5 L/ha)	–	–	C/S
oak, bur (rate/ha)	x	S/NC	–	–	C* (4 L + 6.6 L)	C* (5 L/ha)	–	–	C
pine (rate/ha)	x	NC	–	C* (0.8% v/v)	C* (4 L + 6.6 L)	C* (5 L/ha)	–	C* (334 g/ha)	C* (17.3 L/ha)
plum, wild (rate/ha)	x	S	–	C* (0.6% v/v)	–	–	–	–	–
poison-ivy	x	S	–	C/S	C	C	–	–	C
poison oak (rate/ha)	x	–	–	–	–	C* (2.5 L/ha)	–	–	–
poplar, aspen (rate/ha)	x	C	C* (3 L/ha)	C* (0.6% v/v)	C* (2.1 L + 3.3 L)	C* (2.5 L/ha)	C* (2% v/v)	C* (334 g/ha)	C* (17.3 L/ha)
poplar, balsam (rate/ha)	x	–	C* (3 L/ha)	–	C* (4 L + 6.6 L)	C* (2.5 L/ha)	C* (2% v/v)	C* (334 g/ha)	C* (17.3 L/ha)
prickly-ash	x	NC	–	–	C	C	–	–	–
raspberry, wild (rate/ha)	x	NC	C* (3 L/ha)	C* (0.6% v/v)	S	C* (5 L/ha)	C* (2% v/v)	–	–
rose, wild (rate/ha)	x	NC	C* (3 L/ha)	C* (0.8% v/v)	C	C* (2.5 L/ha)	–	–	C
sassafras (rate/ha)	x	C/S	–	–	–	C* (2.5 L/ha)	–	C* (334 g/ha)	–
snowberry, western (rate/ha)	x	C	–	–	C* (2.1 L + 3.3 L)	–	–	–	–
spruce (rate/ha)	x	NC	–	S/NC	C* (4 L + 6.6 L)	NC	–	C* (334 g/ha)	C* (17.3 L/ha)
sumac, poison (rate/ha)	x	C	–	C* (0.8% v/v)	–	C* (2.5 L/ha)	–	–	–
tamarack (rate/ha)	x	–	–	C* (0.8% v/v)	C* (4 L + 6.6 L)	C* (2.5 L/ha)	–	–	–
viburnum	x	NC	–	–	–	C	–	–	–
walnut (rate/ha)	x	C/S	–	–	–	–	C* (2% v/v)	–	C
willow (rate/ha)	x	SC*	–	C* (0.8% v/v)	C	C* (2.5 L/ha)	–	C* (334 g/ha)	C

[1] Noxious Weed as listed under the *Weed Control Act*, R.S.O. 1990, Chapter W.5.

[2] Numerous products exist, refer to Table 4–1. Herbicides Used in Ontario, page 30.

TABLE 18–4. Herbicide Treatment Rates for Woody Species

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4. Herbicides Used in Ontario, page 27 and Chapter 5. Notes on Adjuvants, page 81.
BRUSH CONTROL			
Stem Foliage Treatments Applied to Runoff – Most deciduous woody species			
Stem foliage treatment of brush should be limited to smaller growth (less than 2 m in height). Treatments should be applied to thoroughly wet the stems and foliage to the point of runoff. This technique is most effective just after full leaf development in late spring or early summer. The choice of herbicides for controlling stands of deciduous brush should be based on the susceptibilities of the predominant species (Table 18–3. Susceptibility of Woody Plants to Various Herbicides and Mixtures as Foliage Sprays, page 435) or whether the brush to be controlled is near homes, recreational areas, sensitive crops etc.			
2,4-D	2,4-D Ester 600 (564 g/L)*	3–8 L/ha (1.2–3.2 L/acre)	· Apply in 1,000–3,000 L/ha water (400–1,200 L/acre). · Apply to sensitive brush species up to 3 m tall after foliage is developed. · Brush above 3 m tall should be cut close to the ground and sprayed when the re-growth is over 0.6 m tall. Repeat treatments may be required. * See Table 4–1. Herbicides Used in Ontario, page 30. for formulations available. See label for specific uses and rates.
	2,4-D Ester 700 (660 g/L)*	3.25–6.78 L/ha (1.3–2.7 L/acre)	
dichlorprop/2,4-D	dichlorprop/2,4-D (610 g/L)*	6–8 L/ha (2.4–3.2 L/acre)	· Apply in 750 to 1,500 L/ha water (300 to 600 L/acre). · Thoroughly wet down all foliage and stems to ground level. · For best results apply on foliage and stems when brush is in full leaf. · Many species require re-treatment the following year. * See Table 4–1. Herbicides Used in Ontario, page 30 for formulations available. See label for specific uses and rates.
	dichlorprop/2,4-D (582 g/L)*	8.75–11.7 L/ha (3.5–4.68 L/acre)	
metsulfuron methyl (167–250 g/ha)	ESCORT (60%) + non-ionic surfactant	100–150 g/ha (40–60 g/acre) + 0.2% v/v	· Apply in enough water to make 1,000 L of spray solution. · Controls woody plants up to 2.5 m in height. If plants exceed this height, cut and spray regrowth. · Spray brush to the point of runoff. · The low rate will control balsam poplar and willow. The higher rate will control cherry and trembling aspen.
triclopyr (1.88–3.78 kg)	GARLON XRT (755 g/L)	2.5–5 L/ha (1–2 L/acre)	· Apply to the point of run-off when the brush is actively growing. · Apply in 1,000 L/ha water (400 L/acre). · Use the higher rate for the more difficult to control species.
glyphosate (3.6–7.2 kg/1,000 L)	glyphosate (360 g/L)*	10–20 L/1,000 L	· Most woody and herbaceous species are controlled. Can be applied during June, July or August. · Injury to grasses will occur; use otner selective products if grasses are to be maintained. * See Table 4–1. Herbicides Used in Ontario, page 30 for formulations available. See label for specific uses and rates.
	glyphosate (480 g/L)*	7.5–15 L/1,000 L	
	glyphosate (500 g/L)*	7.2–14.4 L/1,000 L	
	glyphosate (540 g/L)*	6.67–13.3 L/1,000 L	

TABLE 18–4. Herbicide Treatment Rates for Woody Species (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4. Herbicides Used in Ontario, page 27 and Chapter 5. Notes on Adjuvants, page 81.
BRUSH CONTROL (cont'd)			
Stem Foliage Treatments Applied to Runoff – Most deciduous woody species (cont'd)			
metsulfuronmethyl 12.6%/ aminocyclopyrachlor 39.5%	NAVIUS™ VM Herbicide (52.1%)	334–668 g/ha (135.2–270 g/acre)	· Apply to actively growing brush species after species have leafed out. Thorough coverage is essential. · Apply as a full coverage spray to foliage, stems and limbs using up to 2000 litres of total spray per hectare (800 L/acre) depending on plant species, height and density of growth, and on the type of spray equipment used.
picloram/ 2,4-D (3.05 kg/1,000 L)	TORDON 101 ((1:3.7) 305 g/L)	10 L/1,000 L	· Excluding white ash. · Apply to wet the stems and foliage to the point of runoff when the leaves are fully expanded. · A permit for purchase and use of this product is required.
dicamba (1–1.92 kg/1,000 L) + 2,4-D (1.86–3.72 kg/1,000 L)	VANQUISH (480 g/L) + 2,4-D Ester 600 (564 g/L)* ORACLE (480 g/L) + 2,4-D Ester 600 (564 g/L)* VMD (480 g/L) + 2,4-D Ester 600 (564 g/L)*	2.1–4 L/1,000 L + 3.3–6.6 L/1,000 L	· Apply to the point of runoff when the leaves are fully expanded. · Refer to Table 18–2. Susceptibility of Woody Plants to Various Herbicides and Mixtures as Foliage Sprays, page 426 for the appropriate rate of dicamba and 2,4-D per hectare required to control the targeted woody species. * See Table 4–1. Herbicides Used in Ontario, page 30 for formulations available. See label for specific uses and rates.
dicamba (2.5 kg/1,000 L) + dichlorprop/ 2,4-D (4.9 kg/1,000 L)	VANQUISH (480 g/L) + DESORMONE (680 g/L) ORACLE (480 g/L) + DESORMONE (680 g/L) VMD (480 g/L) + DESORMONE (680 g/L)	5.2 L/1,000 L + 7.15 L/1,000 L	· For white ash and sugar maple. · Apply to the point of runoff when leaves are fully expanded.
Constant Volume Foliar Applications – Most deciduous woody species (excluding white ash)			
For Brush Control on Roadsides and Other Rights-of-Way			
imazapyr (0.72 kg/ha)	ARSENAL POWERLINE (240 g/L)	3 L/ha (1.2 L/acre)	· For maple, poplar, raspberry, and wild rose. · Apply in sufficient water (100–550 L/ha) (40–220 L/acre) to wet all foliage during periods of active growth. · This product can only be applied by licensed applicators.
dichlorprop/2,4-D	dichlorprop/2,4-D (610 g/L)*	6–8 L/ha (2.4–3.2 L/acre)	· Apply in 750–1,500 L/ha water (300–600 L/acre) during periods of active growth. · Use higher rates and water volumes for brush that is dense and tall. * See Table 4–1. Herbicides Used in Ontario, page 30 for formulations available. See label for specific uses and rates.
	dichlorprop/2,4-D (582 g/L)*	8.75–11.7 L/ha (3.5–4.68 L/acre)	
triclopyr (1.88–3.78 kg/ha)	GARLON XRT (755 g/L)	2.5–5 L/ha (1–2 L/acre)	· Apply in a minimum of 200 L/ha water (80 L/acre) during periods of active growth.

TABLE 18–4. Herbicide Treatment Rates for Woody Species (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4. Herbicides Used in Ontario, page 27 and Chapter 5. Notes on Adjuvants, page 81.
Constant Volume Foliar Applications – Most deciduous woody species (excluding white ash) (cont'd)			
For Brush Control on Roadsides and Other Rights-of-Way (cont'd)			
picloram/ 2,4-D (5.28 kg/ha)	TORDON 101 ((1:3.7) 305 g/L)	17.3 L/ha (6.92 L/acre)	· Apply in 200 L/ha (80 L/acre) of spray solution during the active growing season. · Use an approved drift control system or additive. · A permit for purchase and use of this product is required.
dicamba (2 kg/ha) + 2,4-D* (3.8 kg/ha)	VANQUISH (480 g/L) + 2,4-D (470 g/L)*	4.2 L/ha (1.7 L/acre) + 8 L/ha (3.2 L/acre)	· Apply in sufficient water (220–330 L/ha) (88–132 L/acre) to wet all foliage. · Amine or ester formulations of 2,4-D may be used. * See Table 4–1. Herbicides Used in Ontario, page 30 for formulations available. See label for specific uses and rates.
	ORACLE (480 g/L) + 2,4-D (470 g/L)*		
	VMD (480 g/L) + 2,4-D (470 g/L)*		
dicamba (2.5 kg/ha) + dichlorprop/2,4-D (4.9 kg/ha)	VANQUISH (480 g/L) + DIPHENOPROP BK 700 (679 g/L)	5.2 L/ha (2.1 L/acre) + 7.2 L/ha (2.9 L/acre)	· Apply in sufficient water (200–330 L/ha) (80–132 L/acre) to wet all foliage.
	ORACLE (480 g/L) + DIPHENOPROP BK 700 (679 g/L)		
	VMD (480 g/L) + DIPHENOPROP BK 700 (679 g/L)		
Basal-Bark Treatments in Oil as a Carrier			
The basal-bark treatment is useful on a wide range of trees and brush with a trunk diameter up to 10 cm. There are a number of different basal bark techniques including one-sided low volume, thin line and streamline. For oak, hickory, basswood or ash, treatment applications are most effective from February to June. Most other species may be treated at any season of the year. Light, simple equipment, coupled with the possibility of winter operations when access to swampy areas is possible, give this treatment an important role in a brush control program.			
dichlorprop/2,4-D	dichlorprop/2,4-D (610 g/L)*	1.6–2.2 L/100 L	· For most woody species, including conifers. · Mix with mineral oil as a carrier. · Use lower rates for susceptible species and higher rates for hard to kill species. · Spray bark to wet only. · This treatment is not effective for basswood and ash. * See Table 4–1. Herbicides Used in Ontario, page 30 for formulations available. See label for specific uses and rates.
	dichlorprop/2,4-D (582 g/L)*	2.3–3.2 L/100 L	
triclopyr (9.8–14.35 kg/100 L)	GARLON XRT (755 g/L)	13–19 L/100 L	· For most woody species, not including conifers. · Mix GARLON XRT in enough mineral or vegetable oil for a 100 L spray mixture. · One Sided Low Volume – This low volume treatment can be applied to stems less than 15 cm in diameter. Apply the spray to thoroughly wet at least one side of the stem and root crown but not to the point of run-off. · Streamline – Apply sufficient spray to one side of stems less than 8 cm in basal diameter to form a band that is 5 cm in width. The treatment zone should widen to encircle the stem within 30 minutes. Treat both sides of stems which are 8–12 cm in basal diameter. · GARLON RTU is a ready to use blend of triclopyr and mineral oil. Apply in the same manner as GARLON XRT.
	GARLON RTU (144 g/L)	See precautions	

TABLE 18–4. Herbicide Treatment Rates for Woody Species (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4. Herbicides Used in Ontario, page 27 and Chapter 5. Notes on Adjuvants, page 81.
Stump Treatment After Cutting for Most Deciduous Woody Species			
In many cases, it is more desirable to remove existing brush by hand than to spray it and leave the dead material standing. Herbicide stump treatment is particularly useful in preventing the vigorous regrowth that is the characteristic response of many deciduous species after cutting. Moreover killing the stump is the first step towards encouraging it to rot. Most treatments must be applied to freshly cut stumps to achieve maximum effectiveness. For old stumps, it is best to drill several holes or to split stump with a wedge before applying the treatments. Spray regrowth from an old stump along with the stump. Various dye materials may be added to the oil based sprays to assure that all exposed surfaces of the stumps are treated.			
dichlorprop/2,4-D	dichlorprop/2,4-D (610 g/L)*	2.25 L/100 L	· Apply in mineral oil as a carrier.
	dichlorprop/2,4-D (582 g/L)*	3.25 L/100 L	* See Table 4–1. Herbicides Used in Ontario, page 30 for formulations available. See label for specific uses and rates.
triclopyr (9.8–14.35 kg/100 L)	GARLON XRT (755 g/L)	13–19 L/100 L	· Mix GARLON XRT in enough mineral or vegetable oil for a 100 L spray mixture. · Apply to cut stump, thoroughly wet all cut surfaces and any exposed bark. · Treatment can be performed any time after mechanical removal. · GARLON RTU is a ready to use blend of triclopyr and mineral oil. Apply in the same manner as GARLON XRT.
	GARLON RTU (144 g/L)	See precautions	
picloram/ 2,4-D (3.05 kg/10 L)	TORDON 101 ((1:3.7) 305 g/L)	10 L/10 L	· Dilute 1:1 with water or 1:1 with ethylene glycol if below freezing. · A permit for purchase and use of this product is required.
EVERGREEN OR CONIFER CONTROL			
Stem Foliage Treatments with Water as a Carrier			
All of the treatments are applied so as to thoroughly wet all foliage. Use low pressure and apply from 500–1,500 L/ha solution (200–600 L/acre), depending on the amount of foliage. Thorough coverage is particularly important and the addition of a wetting agent will increase effectiveness.			
picloram/2,4-D (3.05 kg/1,000 L)	TORDON 101 ((1:3.7) 305 g/L)	10 L/1,000 L	· Apply when the conifers are actively growing in early summer. · Spray should thoroughly wet all plant parts including stem, foliage, and root collar. · Add 0.25% v/v solution of Sylgard 309 surfactant when controlling conifers. · A permit is required for purchase and use.
picloram/2,4-D (5.28 kg/ha)	TORDON 101 ((1:3.7) 305 g/L)	17.3 L/ha (6.92 L/acre)	· Apply in 200 L/ha of spray solution during the period of active conifer growth in early summer. · Add 0.25–0.375% v/v solution of Sylgard 309 surfactant when controlling conifers. · **Do NOT** prolong application longer than 24 hours after mixing. · A permit for purchase and use of this product is required.
dicamba (1.9 kg/1,000 L) + 2,4-D* (3.8 kg/1,000 L)	VANQUISH (480 g/L) + 2,4-D Amine (470 g/L)*	4 L/1,000 L + 8 L/1,000 L	· Apply in early summer. · Thorough coverage is needed.
	ORACLE (480 g/L) + 2,4-D Amine (470 g/L)*		* See Table 4–1. Herbicides Used in Ontario, page 30 for formulations available. See label for specific uses and rates.

TABLE 18–4. Herbicide Treatment Rates for Woody Species (cont'd)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4. Herbicides Used in Ontario, page 27 and Chapter 5. Notes on Adjuvants, page 81.
EVERGREEN OR CONIFER CONTROL (cont'd)			
Stem-Foliage Treatments with Water as a Carrier (cont'd)			
dicamba + dichlorprop/2,4-D	VANQUISH (480 g/L) + dichlorprop/2,4-D (610 g/L)*	6.25 L/1,000 L + 5.7 L/1,000 L	· Apply in spring or early summer. · Thorough coverage is needed. · Follow instructions on VANQUISH label for tank-mix. * See Table 4–1. Herbicides Used in Ontario, page 30 for formulations available. See label for specific uses and rates.
	VANQUISH (480 g/L) + dichlorprop/2,4-D (582 g/L)*	6.25 L/1,000 L + 6.25 L/1,000 L	
	ORACLE (480 g/L) + dichlorprop/2,4-D (610 g/L)*	6.25 L/1,000 L + 5.7 L/1,000 L	
	ORACLE (480 g/L) + dichlorprop/2,4-D (582 g/L)*	6.25 L/1,000 L + 6.25 L/1,000 L	

19. WATER WEEDS (AQUATIC PLANTS)

Water Weeds (Aquatic Plants)

Types of Aquatic Plants

Aquatic vegetation can vary widely; species include completely submerged plants such as Canada waterweed and algae; free floating plants such as water lilies; and emergent plants such as cattails and bulrushes. Many emergent plants will grow equally well on the moist shoreline or when their lower stems and roots are in water. Where these emergent species have taken possession of the shoreline, control measures must embrace that area as well as the water.

Stonewort and muskgrass are a gray-green to green plant-like algae, attached to the sediment, or free floating. In dense communities this plant-like algae has a very strong musk odour. It is brittle to the touch and will dry to a white powder upon removal from the water.

Tapegrass (wild celery) which is found in many recreational lakes, is resistant to all the currently available herbicides. It has long rubbery leaves and numerous short roots. Control is possible only by mechanical methods.

Aquatic Herbicide Controls

Under the Pesticides Act and Ontario Regulation 63/09 a person requires an Aquatic Vegetation exterminator licence to use a herbicide to control aquatic plants and a permit issued by the Ministry of the Environment and Climate Change (MOECC) to perform a water extermination unless exempt under the Regulation.

Subsection 82 and 83 of the Regulation provide the authorization to perform water exterminations and prescribe the exemptions from requiring a water exterminator's licence and/or permit for the performance of a water extermination.

Subsection 83(2) of the Regulation exempts a person from requiring an Aquatic Vegetation licence if he/she performs a water extermination in, on or over a portion of surface water that is located within the boundaries of premises owned or occupied by him/her (or his/her full time employer).

Subsection 83(3) of the Regulation exempts a person from requiring a permit to perform a water extermination if:

- He/she performs a water extermination in, on or over a portion of surface water that is located within the boundaries of premises owned or occupied by him/her (or his/her full time employer), and,
- the extermination is being done on a water body that is wholly contained on those premises and the water body does not discharge, directly or indirectly (other than by percolation) into any water or watercourse that is located wholly or partly outside the boundary of the premises.

A drainage ditch is defined in the Regulation as an artificial watercourse, added to the natural land drainage system, primarily to collect and convey water and that, for some period each year, does not contain moving water.

The use of pesticides in a drainage ditch to control plants that emerge from or float on the surface of the water as long as the drainage ditch does not contain moving water at the time of the extermination does not require a permit under the following conditions:

- A licensed exterminator, or a farmer who has successfully completed the Grower Pesticides Safety Course (e.g., a qualified farmer) applying Class 3, 4, 5, 6 or 7 pesticides that are appropriately labelled for that use.
- A person using Class 5, 6 or 7 pesticides that are appropriately labelled for that use.
- A farmer using Class 4 pesticides that are appropriately labelled for that use.

Sale of Aquatic Herbicides

In Ontario, aquatic herbicides are classified as non-domestic pesticide products (Class 3 or 4). Licensed pesticide vendors may sell an aquatic herbicide only to those persons that possess the appropriate licence and/or permit or present a letter signed by the MOECC Director under the Act confirming that the person presenting the letter is exempt from an exterminator licence and/or permit.

A person who holds an Aquatic Vegetation exterminator licence may purchase a Class 3 or 4 herbicide for aquatic plant control. However, as noted above, a permit is required unless the exterminator is performing a water extermination on premises he/she owns or occupies or on premises that are owned or occupied by his/her full-time employer and the extermination is being done in, on, or over surface water that is wholly contained on those premises and the water body does not discharge, directly or indirectly (other than by percolation) into any water or watercourse that is located wholly or partly outside the boundary of the premises.

In situations where a person is exempt from both the requirement for an Aquatic Vegetation exterminator licence and a permit (as described above) the person must obtain a letter signed by an MOECC Director under the Act confirming that he/she is exempt from requiring an Aquatic Vegetation exterminator licence and present the letter to the vendor to purchase a Class 3 or 4 herbicide for aquatic plant control.

Qualified farmers can purchase Class 3 and 4 pesticides for use in their own agricultural operation. Therefore, the above noted licence and/or permit exemptions apply. Farmers who present a registration number under the Farm Registration and Farm Organization Funding Act, 1993, or a signed Farmer Self Declaration form can purchase a Class 4 pesticide for use in their own agricultural operation.

Non-chemical Control Methods

Management techniques for vegetation control in ponds include minimizing nutrient input, dredging excess sediment, logs and other organic debris, decreasing the surface to depth ratio and increasing the rate of pond turnover (flushing). Some aquatic plant and algae life should be accepted and tolerated as a vital component of a healthy ecosystem.

Reducing or eliminating the flow of nutrients into water bodies is an effective preventative measure to control excessive aquatic weeds. Herbicides only provide temporary control of nuisance aquatic vegetation. Alternate methods such as mechanical removal of submergent plants, dredging or substrate alteration of drainage ditches can provide longer-term control. Mechanical control measures may have an impact on fish habitat and therefore would require approval from the Ministry of Natural Resources and Forestry.

TABLE 19–1. Herbicide Treatment Rates for Water Weeds (Aquatic Plants)

ACTIVE INGREDIENT (rate)	TRADE NAME (concentration)	PRODUCT RATE	PRECAUTIONS For more information, see Chapter 4, Herbicides Used in Ontario, page 27 and Chapter 5, Notes on Adjuvants, page 81.
ALGAE AND VASCULAR SUBMERGENTS (e.g., Chara, Canada Waterweed, Coontail, Water Milfoil, Bladderwort, Pondweed)			
copper (6.5–9 kg/m of water depth)	POLYDEX BACTERIOSTATIC ALGAECIDE MC (5%) POLYDEX BACTERIOSTATIC ALGAECIDE (5%) THINK PURITY ALGAECIDE SOLUTION (5%)	1.6–16 mL/1,000 L	· To control algae in ponds, lagoons, dugouts and potable water tanks. · **Do NOT** apply or allow discharge to lakes, flowing water or ponds with outflow. · **This product is toxic to fish, aquatic invertebrates and plants.** · Effective application rate depends on water condition and the extent of micro-organisms present.
diquat (aquatic) (4.4–7 kg/ha)	REWARD (240 g/L)	Rate depends on water depth: · less than 1.5 m – use 18.3 L/ha (7.4 L/acre). · more than 1.5 m – use 25–29.2 L/ha (10.1–11.8 L/acre).	· For control of coontail, Canada waterweed and pondweed in still or slow-moving water of farm dugouts, farm ponds, farm ditches, lakes and canals. · Treat dense populations of duckweed as submergent and apply as surface spray on foliage. · Chara (stonewort, muskgrass) are not controlled. · **Do NOT** use treated water for animal consumption or swimming for at least 24 hours. · **Do NOT** use for human consumption or irrigation for at least 5 days. · To avoid oxygen depletion, treat only one-quarter to one-third of the area at a time. · Apply when plants are young and growing vigorously. · Application to dense growth of mature weeds will not give satisfactory control.
EMERGENTS (e.g., Duckweed, Cattail)			
acrolein (aquatic)	MAGNACIDE H (95%)	22 L/m^3/sec–2,000 L/m^3/sec[1]	· For control of duckweed in irrigation canals. · **Do NOT** permit dairy animals to drink treated water. · **Do NOT** use where waters will flow into potential sources of drinking water. · Prevent the release of treated water from endangering fish in natural bodies of water and reservoirs.
diquat (aquatic) (4.4–7 kg/ha)	REWARD (240 g/L)	Rate depends on water depth: · less than 1.5 m – use 18.3 L/ha (7.4 L/acre). · more than 1.5 m – use 25–29.2 L/ha (10.1–11.8 L/acre).	· For control of duckweed. · Apply by directed surface spray on foliage. · Use in 1,700–2,200 L/ha (680–880 L/acre) water. · See REWARD note in previous section.

TABLE 19–2. Habitats and Herbicide Susceptibility of Common Aquatic Plants

LEGEND: VC = very common C = common I = infrequent R = rare S = susceptible I = intermediate R = resistant (Weeds may be damaged but will likely recover)
M = Manual or mechanical methods equally as effective as herbicides.
M* = Manual or mechanical methods are generally more effective than herbicides.
M** = Manual or mechanical methods are the only control measure currently available.
– = Insufficient information available to make a rating

Plant	**spring-fed pond**	**dugout**	**soft water lake** (e.g., typical Muskoka lake)	**hard water lake** (e.g., typical Kawartha lake)	**wet ditch** (contains water at time of treatment)	**dry ditch** (contains no water at time of treatment)	**mechanical control**	**copper compound** (Polydex)	**diquat** (Reglone A)
Algae									
Pithophora	–	–	–	–	–	–	–	–	S–I
Spirogyra spp.	VC	VC	C–I		VC	I	–	S	R
Ulothrix spp.	C	VC	–	–	VC	–	–	S	R
Mougeotia spp.	C	VC	–	–	VC	–	–	S	R
Cladophora spp.	VC	VC	C	VC	VC	VC	–	S	R
Muskgrass (Chara spp.)	VC	I	C–I	VC–I	VC	R	–	S	R
Stonewort (Nitella spp.)	I	R	VC	R	R	R	–	S	R
Submergent Macrophytes									
Sago pondweed (*P. pectinatus*)	I	C–I	–	VC	–	–	–	R	S
Curly-leaf pondweed (*P.crispus*)	C	VC	–	VC	–	–	–	R	S
Bassweed (*P.amplifolius*)	R	C	–	C	–	–	–	R	I
Richardson pondweed (*P. richardsonii*)	–	–	–	VC–C	–	–	–	R	S–I
Flat-stemmed pondweed (*P. zosteriformis*)	–	–	–	C	–	–	–	R	S
Other narrow-leaf pondweed (*Potamogeton spp.*)	I	C	C	VC–C	–	–	–	R	S
Eurasian water milfoil (*Myriophyllum spicatum*)	–	–	VC		–	–	–	R	VS
Native milfoil (*M. exalbescens* and others)	C	–	C	VC	–	–	–	R	VS
Bladderwort (*Utricularia vulgaris*)	–	C	–	C	–	–	–	R	S–I
Coontail (*Ceratophyllum demersum*)	–	C	–	VC	–	–	–	R	I
Water stargrass (*Heteranthera dubia*)	–	–	–	C	–	–	–	R	S–I
Tape grass (*Vallisneria americana*)	R	I	C	VC	R	R	M**	R	R
Water naiad (*Najas flexilis*)	–	I	–	VC	–	–	–	R	S
Canada waterweed (*Elodea canadensis*)	–	C	–	VC	–	–	–	R	I

TABLE 19–2. Habitats and Herbicide Susceptibility of Common Aquatic Plants (cont'd)

LEGEND: VC = very common C = common I = infrequent R = rare S = susceptible I = intermediate R = resistant (Weeds may be damaged but will likely recover)
M = Manual or mechanical methods equally as effective as herbicides.
M* = Manual or mechanical methods are generally more effective than herbicides.
M** = Manual or mechanical methods are the only control measure currently available.
– = Insufficient information available to make a rating

Plant	**spring-fed pond**	**dugout**	**soft water lake** (e.g., typical Muskoka lake)	**hard water lake** (e.g., typical Kawartha lake)	**wet ditch** (contains water at time of treatment)	**dry ditch** (contains no water at time of treatment)	**mechanical control**	**copper compound** (Polydex)	**diquat** (Reglone A)
Emergents									
Cattails (*T. latifolia, T. angustifolia*)	VC	VC	–	VC	VC	I–C	M	R	R
Bulrush (*Scirpus* spp.)	–	–	C	VC	C	C	M	R	–
Sedge (*Carex* spp+A42)	–	–	C	C	C	VC	M	R	–
Bur reed (*Sparganium* spp.)	C	–	C	C	C	VC	M	R	–
Water plantain (*Alisma* spp.)	–	–	I	C	C	VC	–	R	–
Pipewort (*Eriocaulon* spp.)	R	R	C	R	R	R	M*	R	–
Arrowhead (*Sagittaria* spp.)	–	C	–	VC	I–C	–	–	R	–
Pickerelweed (*Pontederia* spp.)	–	–	VC	–	I	R	–	R	–
Water smartweed (*Polygonium amphibium*)	I	I	–	–	–	–	–	R	–
Water shield (*Brasenia* spp.)	–	–	C	–	–	–	–	R	–
White water lily (*Nymphaea* spp.)	–	–	C	C	–	–	M*	R	–
Yellow water lily (*Nuphar* spp.)	–	C–I	C	C	–	–	M*	R	–
Duckweed (*Lemna* spp.)	R	C	I–R	VC	–	–	–	R	S
Duckmeal (*Wolffia* spp.)	R	C–I	I–R	VC	–	–	–	R	S

20. APPENDICES

APPENDIX A. Contributors to Guide to Weed Control, 2016–2017

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APPENDIX B. Weed Control Glossary

Acid Equivalent (abbreviation – a.e.) (2,4-D, glyphosate) – the active part of the acid herbicide being used – usually indicated in grams/L on the label.

Active Ingredient – the chemical in a formulated product that is responsible for the herbicide effects.

Adjuvant – an ingredient added to a herbicide formulation or spray mixture to aid or modify the action of the herbicide, or the physical characteristics of the mixture.

Amine – acid or anionic herbicides can be formulated as ammonium salts or amines. 2,4-D amines are relatively non-volatile under most climatic conditions.

Annual Plant – completes its life cycle within a one-year period. Summer annuals complete their life cycle between spring and fall. Winter annuals germinate in fall, overwinter and then flower and complete their life cycle the following spring or summer.

Band Treatment – a herbicide applied as a narrow strip over the crop row, usually followed by inter-row cultivation.

Biennial Plant – completes its life cycle within a two-year period. Germinates in the spring, overwinters, flowers the following spring or summer and dies back the following fall.

Carrier – the diluent or material added to a herbicide product to facilitate its even distribution over the target area. The carrier is often water but it may also be granular products, oil or other solvents.

Compatible – compounds or formulations that can be mixed and applied together without undesirably altering their separate effects or the physical properties of the mixture.

Contact Chemicals – chemicals that kill only the parts of the plant on which they are sprayed. Movement within the plant is minimal.

Cotyledons – the seed leaves. Often visible when large seeds are opened. These are the first leaves visible in the germinated seedling. Broad-leaved crops or weeds have two cotyledons (dicots). Grasses (monocots) have one.

Directed Treatment – a treatment directed onto the weeds or soil in such a manner as to avoid contact with the crop.

Dormant – a resting stage similar to the condition of a plant during the winter.

Emergence – the time at which the seedling first appears above the ground.

Escape – a plant in a treated area that has been missed or survived the treatment.

Ester – some acid herbicides are reacted with alcohols to produce ester formulations. Ester formulations of 2,4-D and related herbicides can vaporize under hot conditions after treatment and cause unwanted damage by moving away from the treated area.

Formulation – means the same as Product – an active ingredient processed with other materials or formulants to make it easier to apply and/or more effective. Herbicides are rarely sold as pure active ingredients (2,4-D acid), they are sold as formulated mixtures (i.e., 2,4-D amine, sodium salt or ester with added emulsifiers, adjuvants, carriers, etc.).

GMO – a genetically modified organism (GMO) is an organism whose genetic material has been altered using genetic engineering techniques as opposed to traditional breeding methods.

GPS – global positioning system (GPS) is a space based global navigation satellite system that provides location and time information. It's primary application in pest management has been for accurate navigation of equipment so as to minimize the overlaps of pesticide applications.

Half-Life – the time required for 50% of a herbicide to be degraded or inactivated in soil or water.

Herbicide – a chemical that is toxic to plants.
Herbicide Tolerant Crops (abbreviation – HTCs) – New varieties of crops that have been developed by classical breeding or transgenic techniques to be tolerant to specific herbicides.

Hormone-Type Herbicide – includes 2,4-D, 2,4-DB, mecoprop MCPA, MCPB, dichlorprop, dicamba and triclopyr, picloram. At extremely low concentrations, these chemicals can stimulate and/or disrupt the growth of broadleaved plants.

Non-Selective Herbicide – a chemical used in such a manner that all exposed vegetation is damaged.

Perennial Plant – lives for more than 2 years.

Product – the contents of a herbicide container as marketed. In addition to the active ingredient, it may also contain other solvents, surfactants or carriers that are referred to as inert ingredients or formulants.

Program – application of one or more herbicides at two different stages of crop and/or weed growth. The second herbicide application is used to provide control of the weeds either escaping the original herbicide treatment or that are problems at different periods in the growth of the crop.

Resistant Weeds (Herbicide Resistant Weeds) – the inherited ability of some weeds in the population of a particular weed species to survive a herbicide application to which most of the original population was susceptible.

Selective Herbicide – a chemical used in such a manner that it will kill weeds on a growing crop without damaging the crop.

Sodium Salt – some acid or anionic herbicides can be formulated as sodium salts (e.g., 2,4,-D).

Soil Sterilant – a soil active herbicide that is applied at a sufficiently high rate to prevent all plant growth for at least one season.

Surfactant – a chemical added to the herbicide formulation or to the spray solution to improve the dispersing, spreading, sticking or wetting properties of the spray mixture.

Susceptible – a crop that may be damaged or a weed that may be readily controlled by the label rate of herbicide.

Tank-Mix – two chemicals that are packaged separately and mixed in the sprayer tank.

Translocated Herbicide – a chemical herbicide that moves within the plant.

APPENDIX C. Ontario Ministry of Agriculture, Food and Rural Affairs Crop Advisory Staff List

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A complete list of Ontario Ministry of Agriculture, Food and Rural Affairs advisory staff is available at ontario.ca/crops.

Agricultural Information Contact Centre
Provides province-wide, toll-free technical and business information to commercial farms, agri-businesses and rural businesses.
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REGION County	Address	Telephone/Fax
Central Region Toronto, Halton, Peel, York, Durham, Muskoka, Simcoe	5775 Yonge Street, 8th Floor Toronto, ON M2M 4J1	Tel: 416-326-6700 Toll Free: 1-800-810-8048 Fax: 416-325-6345
West-Central Region Haldimand, Norfolk, Niagara, Hamilton-Wentworth, Dufferin, Wellington, Waterloo, Brant	Ontario Government Building 119 King Street West, 12th Floor Hamilton, ON L8P 4Y7	Tel: 905-521-7640 Toll Free: 1-800-668-4557 Fax: 905-521-7820
Eastern Region Frontenac, Hastings, Lennox & Addington, Prince Edward, Leeds & Grenville, Prescott & Russell, Stormont/Dundas & Glengarry, Haliburton, Peterborough, Kawartha Lakes, Northumberland, Renfrew, Ottawa, Lanark, District of Nipissing (Twp of South Algonquin)	1259 Gardiners Road, Unit 3 PO Box 22032 Kingston, ON K7M 8S5	Tel: 613-549-4000 Toll Free: 1-800-267-0974 Fax: 613-548-6908
Southwestern Region Elgin, Middlesex, Oxford, Essex, Kent, Lambton, Bruce, Grey, Huron, Perth	733 Exeter Road London, ON N6E 1L3	Tel: 519-873-5000 Toll Free: 1-800-265-7672 Fax: 519-873-5020
Northern Region (East) Manitoulin, Nipissing, Parry Sound, Sudbury, Algoma (East), Timiskaming, Sault Ste. Marie	199 Larch Street, Suite 1201 Sudbury, ON P3E 5P9	Tel: 705-564-3237 Toll Free: 1-800-890-8516 Fax: 705-564-4180
Northern Region (West) Algoma (West), Cochrane, Kenora, Rainy River, Thunder Bay	435 James Street South, Suite 331 Thunder Bay, ON P7E 6S7	Tel: 807-475-1205 Toll Free: 1-800-875-7772 Fax: 807-475-1745
Standards Development Branch	Pesticides Section 40 St. Clair Avenue West, 7th Floor Toronto, ON M4V 1M2	Tel: 416-327-5519 Fax: 416-327-2936
Approvals Branch	Pesticides Licensing 2 St. Clair Avenue West, 12A Floor Toronto, ON M4V 1L5	Tel: 416-314-8001 Toll Free: 1-800-461-6290 Fax: 416-314-8452

AGRICULTURE & AGRI-FOOD CANADA RESEARCH CENTRES

www.agr.gc.ca/index_e.php

Eastern Cereals and Oilseeds Research Centre
960 Carling Avenue
Ottawa, ON K1A 0C6
Tel: 613-759-1952

Greenhouse and Processing Crops Centre
2585 County Road 20
Harrow, ON N0R 1G0
Tel: 519-738-2251

Guelph Food Research Centre
93 Stone Road West
Guelph, Ontario N1G 5C9
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Southern Crop Protection and Food Research Centre
1391 Sandford Street
London, ON N5V 4T3
Tel: 519-457-1470

Vineland Research Farm
4902 Victoria Avenue North
Vineland, ON L0R 2E0
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CANADIAN FOOD INSPECTION AGENCY REGIONAL OFFICES (PLANT PROTECTION)

www.inspection.gc.ca/english/toce.shtml
Belleville
345 College Street East
Belleville, ON K8N 5S7
Tel: 613-969-3333

Brantford
625 Park Road North, Suite 6
Brantford, N3T 5P9
Tel: 519-753-3478

Guelph
174 Stone Road West
Guelph, ON N1G 4T1
Tel: 519-837-9400

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709 Main Street West, Suite 101
Hamilton, ON L8S 1A2
Tel: 905-572-2201

London
19-100 Commissioners Road East
London, ON N5Z 4R3
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Ottawa District
38 Auriga Drive, Unit 8
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Simcoe, ON N3Y 4N5
Tel: 519-426-7127

Department of Plant Agriculture, Vineland
Box 7000, 4890 Victoria Avenue North
Vineland Station, ON L0R 2E0
Tel: 905-562-4141

Lab Services Division
95 Stone Road West
Guelph, ON N1H 8J7
www.guelphlabservices.com

Trace Organic and Pesticide Contaminants
Tel: 519-823-1268

Pest Diagnostic Clinic
Tel: 519-767-6256

APPENDIX F. The Metric System

Linear Measures (length)

10 millimetres (mm) = 1 centimetre (cm)
100 centimetres (cm) = 1 metre (m)
1,000 metres = 1 kilometre (km)

Square Measures (area)

100 m × 100 m = 10,000 m^2 = 1 hectare (ha)
100 ha = 1 square kilometre (km^2)

Cubic Measures (volume)

Dry Measure

1,000 cubic millimetres (mm^3) = 1 cubic centimetre (cm^3)
1,000,000 cm^3 = 1 cubic metre (m^3)

Liquid Measure

1,000 millilitres (mL) = 1 litre (L)
100 L = 1 hectolitre (hL)

Weight-Volume Equivalents (for water)

(1.00 kg) 1,000 grams = 1 litre (1.00 L)
(0.50 kg) 500 g = 500 mL (0.50 L)
(0.10 kg) 100 g = 100 mL (0.10 L)
(0.01 kg) 10 g = 10 mL (0.01 L)
(0.001 kg) 1 g = 1 mL (0.001 L)

Weight Measures

1,000 milligrams (mg) = 1 gram (g)
1,000 g = 1 kilogram (kg)
1,000 kg = 1 tonne (t)
1 mg/kg = 1 part per million (ppm)

Dry–Liquid Equivalents

1 cm^3 = 1 mL
1 m^3 = 1,000 L

Metric to Imperial (Approximate)

litres per hectare × 0.09 = Imp. gallons per acre
litres per hectare × 0.11 = U.S. quarts per acre
litres per hectare × 0.36 = Imp. quarts per acre
litres per hectare × 0.43 = U.S. quarts per acre
litres per hectare × 0.71 = Imp. pints per acre
litres per hectare × 0.86 = U.S. pints per acre
millilitres per hectare × 0.014 = U.S. fluid ounces per acre
grams per hectare × 0.015 = ounces per acre
kilograms per hectare × 0.89 = pounds per acre
tonnes per hectare × 0.45 = tons per acre

Imperial to Metric (Approximate)

Imp. gallons per acre × 11.23 = litres per hectare (L/ha)
U.S. gallons per acre × 9.35 = litres per hectare (L/ha)
Imp. quarts per acre × 2.8 = litres per hectare (L/ha)
U.S. quarts per acre × 2.34 = litres per hectare (L/ha)
Imp. pints per acre × 1.4 = litres per hectare (L/ha)
U.S. pints per acre × 1.17 = litres per hectare (L/ha)
Imp. fluid ounces per acre × 70 = millilitres per hectare (mL/ha)
U.S. fluid ounces per acre × 73 = millilitres per hectare (mL/ha)
tons per acre × 2.24 = tonnes per hectare (t/ha)
pounds per acre × 1.12 = kilograms per hectare (kg/ha)
pounds per acre × 0.45 = kilograms per acre (kg/acre)
ounces per acre × 70 = grams per hectare (g/ha)

Liquid Equivalents (Approximate)

Litres/Hectare		*Approximate Gallons/Acre*	
		Imp. Gallons	*U.S. Gallons*
50	=	4.45	5.35
100	=	8.90	10.70
150	=	13.35	16.05
200	=	17.80	21.40
250	=	22.25	26.75
300	=	26.70	32.10

Dry Weight Equivalents (Approximate)

Grams/Hectare		*Ounces/Acre*
100	=	1½
200	=	3
300	=	4¼
500	=	7
700	=	10

Kilograms/Hectare		*Pounds/Acre*
1.10	=	1
1.50	=	1¼
2.00	=	1¾
2.50	=	2¼
3.25	=	3
4.00	=	3½
5.00	=	4½
6.00	=	5¼
7.50	=	6¾
9.00	=	8
11.00	=	10
13.00	=	11½
15.00	=	13½

Metric Conversions (Approximate)

5 mL = 1 tsp
15 mL = 1 tbsp
28.5 mL = 1 fl. oz

Metric to Imperial Conversions (Approximate)

Length

1 millimetre (mm) = 0.04 inch
1 centimetre (cm) = 0.40 inch
1 metre (m) = 39.40 inches
1 metre (m) = 3.28 feet
1 metre (m) = 1.09 yards
1 kilometre (km) = 0.62 mile

Area

1 square centimetre (cm²) = 0.16 square inch
1 square metre (m²) = 10.77 square feet
1 square metre (m²) = 1.20 square yards
1 square kilometre (km²) = 0.39 square mile
1 hectare (ha) = 107,636 square feet
1 hectare (ha) = 2.5 acres

Volume (dry)

1 cubic centimetre (cm³) = 0.061 cubic inch
1 cubic metre (m³) = 1.31 cubic yards
1 cubic metre (m³) = 35.31 cubic feet
1,000 cubic metres (m³) = 0.81 acre-foot
1 hectolitre (hL) = 2.8 bushels

Volume (liquid)

1 millilitre (mL) = 0.035 fluid ounce
1 litre (L) = 1.76 pints
1 litre (L) = 0.88 quart
1 litre (L) = 0.22 gallon (Imp.)
1 litre (L) = 0.26 gallon (U.S.)

Weight

1 gram (g) = 0.035 ounce
1 kilogram (kg) = 2.21 pounds
1 tonne (t) = 1.10 short tons
1 tonne (t) = 2,205 pounds

Pressure

1 kilopascal (kPa) = 0.15 pounds/in²

Speed

1 metre per second = 3.28 feet per second
1 metre per second = 2.24 miles per hour
1 kilometre per hour = 0.62 miles per hour

Temperature

°F = (°C × 9/5) + 32

Imperial to Metric Conversions (Approximate)

Length

1 inch = 2.54 cm
1 foot = 0.30 m
1 yard = 0.91 m
1 mile = 1.61 km

Area

1 square foot = 0.09 m²
1 square yard = 0.84 m²
1 acre = 0.40 ha

Volume (dry)

1 cubic yard = 0.76 m³
1 bushel = 36.37 L

Volume (liquid)

1 fluid ounce (Imp.) = 28.41 mL
1 pint (Imp.) = 0.57 L
1 gallon (Imp.) = 4.55 L
1 gallon (U.S.) = 3.79 L

Weight

1 ounce = 28.35 g
1 pound = 453.6 g
1 ton = 0.91 tonne

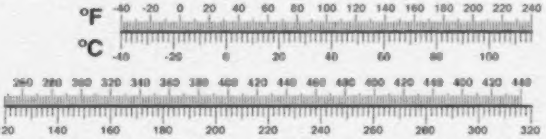
Pressure

1 pound per square inch = 6.90 kPa

Temperature

°C = (°F – 32) × 5/9

TEMPERATURE



For exact values the formula is:
Fahrenheit to Celsius: subtract 32 from number of °F, then multiply by $^5/_9$.
Celsius to Fahrenheit multiply °C by $^9/_5$ then add 32.

Abbreviations

% = per cent (by weight)
ai = active ingredient
AP = agricultural powder
cm = centimetre
cm² = square centimetre
DG = dispersible granular
DP = dispersible powder
E = emulsifiable
e.g. = for example
EC = emulsifiable concentrate
F = flowable
g = gram
Gr = granules, granular
ha = hectare
kg = kilogram
km/h = kilometres per hour
kPa = kilopascal
L = litre
m = metre
m/s = metres per second
m² = square metre
mL = millilitre
mm = millimetre
SC = sprayable concentrate
SP = soluble powder
t = tonne
W = wettable (powder)
WDG = water dispersible granular
WP = wettable powder

APPENDIX G. Herbicide Companies and Agents

Code	Name	Phone	Website
ADJ	ADJUVANTS PLUS INC.	1-877-512-4659	www.adjuvantsplus.com
AEF	AEF GLOBAL INC.	1-866-622-3222	www.aefglobal.com
AGR	AGRIUM ADVANCED TECHNOLOGIES	1-519-757-0077	www.agriumat.com/ca
BAK	BAKER HUGHES CANADA	1-877-285-9910	www.bakerhughes.com/canada
BAZ	BASF CANADA INC.	1-877-371-2273	www.agsolutions.ca
BCZ	BAYER CROPSCIENCE INC.	1-888-283-6847	www.bayercropscience.ca
CAU	CHEMINOVA CANADA	1-888-316-6260	www.cheminova.com
CRE	CROMPTON CORPORATION	1-800-265-2156	www.chemtura.com
DUQ	E.I. DUPONT CANADA COMPANY	1-800-667-3925	www.dupont.ca/ag/
DWE	DOW AGROSCIENCES CANADA INC.	1-800-667-3852	www.dowagro.com/ca
ENF	THE ENVIRONMENTAL FACTOR	1-905-571-5824	www.environmentalfactor.com
FMS	FREEPORT-MCMORAN SIERRITA INC.	1-800-424-9300	—
GOW	GOWAN COMPANY	1-800-883-1844	www.gowanco.com
GRN	GRIFFIN CORP.	1-912-242-8635	—
GRQ	AXSYS DIRECT MANUFACTURING	1-866-543-5276	www.simplyboss.com
INT	INTERPROVINCIAL COOPERATIVE LIMITED	1-204-233-3461	www.ipco.ca
LPH	LACTO PRO-TECH INC.	1-450-774-5757	info@lactoprotech.com
LOI	LOVELAND PRODUCTS INC.	1-970-685-3300	www.lovelandproducts.com
MKC	MAKHTESHIM AGAN N.A.	1-905-304-1168	www.manainc.ca
MOX	MONSANTO CANADA INC.	1-800-667-4944	www.monsanto.ca
NAM	NEW AGCO INC.	1-246-418-9768	www.newagco.com
NEF	NEUDORFF NORTH AMERICA	1-250-652-5888	www.neudorff.com
NOC	NORAC CONCEPTS INC.	1-519-821-3633	www.noracconcepts.com
NUA	NUFARM AGRICULTURE INC.	1-800-868-5444	www.nufarm.ca
OCI	OCION WATER SCIENCES GROUP	1-800-567-1191	www.ocion.com
PDW	POND WIZARD PRODUCTS	1-866-543-5276	www.pondwizard.ca
PLG	PLANT PRODUCTS CO. LTD.	1-800-387-2449	www.plantprod.com
SAR	SARRITOR	1-514-220-7142	—
SGF	SCOTTS CANADA LTD.	1-800-668-5669	www.scottscanada.ca
SYZ	SYNGENTA CROP PROTECTION CANADA INC.	1-800-459-2422	www.syngenta.ca
TES	TESSENDERLO KERLEY INC.	1-515-201-2649	www.NovaSource.com
TIU	ECOVAL	1-866-298-2229	www.ecoval.ca
UAG	UNITED AGRI PRODUCTS	1-800-265-4624	www.uap.ca
VAJ	VALENT CANADA INC.	1-519-767-9262	www.valent.ca
WBR	WILBUR-ELLIS COMPANY OF CANADA LTD.	1-519-767-9262	www.wilburellis.com

APPENDIX H. List of Important Weed Management Websites

Name	Phone	Website
Ontario Pesticides Advisory Committee	1-416-314-9233	opac.gov.on.ca
OMAFRA Weeds Page	—	ontario.ca/crops
Product Labels	—	bit.ly/herbicidelabels
Canadian Weed Science Society	—	weedscience.ca
Herbicide Resistant Weeds In Ontario	—	plant.uoguelph.ca/resistant-weeds/
Herbicide Selector – Field Crops (Ontario)	—	pestmanager.ca
Weed Identification – Ontario	—	ontarioweeds.com

APPENDIX I. Spraying Application Record

Application Equipment Used:

Tank Capacity: **Nozzle Type and Pressure:** **Comments:**

Tractor Speed or Gear and RPM:

Calibrated Application Rate per Hectare or Acre:

Application Information								Environment Information		
Field Identification Location and Size	Application Date and Time	Crop and Stage of Growth	Product Group (Resistance)	Product (Concentration)	Product (rate/ha or acre)	Water (rate/ha or acre)	No. of Tanks (per field)	Wind Speed and Direction	Temperature	Soil Moisture

Emergency and First-Aid Procedures for Pesticide Poisoning

For a major spill, a theft or a fire involving a pesticide call the Ministry of the Environment and Climate Change at **1-800-268-6060.**

For pesticide poisonings and pesticide injuries call the Poison Information Centre:

Toronto 1-800-268-9017
1-877-750-2233 (TTY)

PREVENT ACCIDENTS

- **Read the label.** Follow all the precautions the label recommends. Read the First Aid section of the label BEFORE you begin to handle any pesticide.
- **Make sure that someone knows** what pesticides you are working with and where you are.
- **Keep a file of labels and product Material Safety Data Sheets (MSDS) for the pesticides you use.** Make sure everyone knows where to find this in case of an emergency.
- **Post emergency numbers near all telephones.**
- **Keep clean water, paper towels, extra gloves and clean coveralls close by** in case you spill pesticide on yourself.

If someone has been working with pesticides and you see any possible symptoms of pesticide poisoning or injury, take emergency action immediately.

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IF AN ACCIDENT OR POISONING HAPPENS

- Protect yourself from injury first.
- Stop the exposure to the pesticide. Move the victim away from the contaminated area.
- Check the four basic facts — identify the pesticide, the quantity, the route of entry and time of exposure.
- Call an ambulance or the Poison Information Centre.
- Start first aid. This is not a substitute for professional medical help.
- **Provide the label, MSDS sheet or container to emergency personnel** at the scene — or take it with you to the hospital. Do not transport pesticide containers in the passenger compartment of the vehicle.

FIRST AID

If a pesticide comes in contact with skin:

- remove all contaminated clothing; wash skin thoroughly with lots of soap and warm water
- dry skin well and cover with clean clothing or other clean material.

If pesticide comes in contact with eyes:

- hold eyelids open; wash the eyes with clean running water for 15 minutes or more.

If pesticide was inhaled:

- move the victim to fresh air and loosen tight clothing
- give artificial respiration if the victim is not breathing.

Do not breathe in the exhaled air from the victim — you could also be poisoned.

If a pesticide was swallowed:

- **call the Poison Information Centre IMMEDIATELY.**

Emergency numbers are listed at the front of each Bell telephone directory.

To obtain copies of this or any other OMAFRA publication, please order:

- online at ontario.ca/publications
- by phone through the ServiceOntario Contact Centre, Monday to Friday, 8:30 AM to 5:00 PM ET
  - 416-326-5300
  - 416-326-3408 (TTY)
  - 1-800-668-9938, toll-free across Canada
  - 1-800-368-7095 (TTY), toll-free across Ontario

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ontario.ca/crops